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COMPILATION OF TECHNICAL EDUCATION INSTRUCTIONAL MATERIALS, SUPPLEMENT II, INSTITUTE PRESENTATIONS, NATIONAL LEADERSHIP DEVELOPMENT INSTITUTES IN TECHNICAL EDUCATION (SUMMER, 1966).

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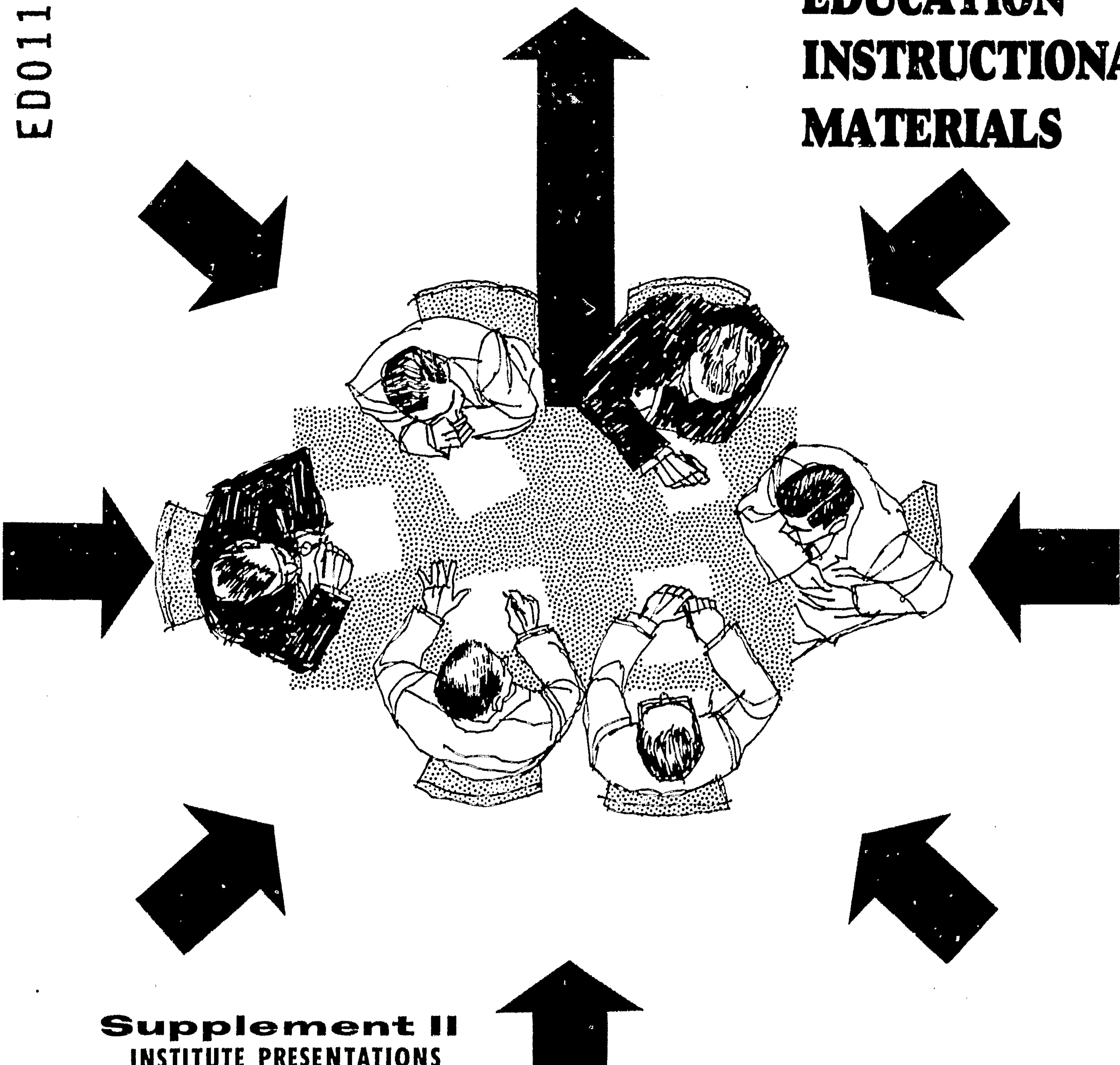
INSTITUTES FOR LEADERSHIP TRAINING WERE CONDUCTED BY COLORADO STATE UNIVERSITY, OKLAHOMA STATE UNIVERSITY, RUTGERS--THE STATE UNIVERSITY, THE UNIVERSITY OF FLORIDA, AND THE UNIVERSITY OF ILLINOIS AND COORDINATED BY THE CENTER FOR VOCATIONAL AND TECHNICAL EDUCATION AT THE OHIO STATE UNIVERSITY. PARTICIPANTS WERE 195 LEADERS AND POTENTIAL LEADERS IN TECHNICAL EDUCATION REPRESENTING 46 STATES AND PUERTO RICO. THE SUBJECT AREAS OF THE PRESENTATIONS WERE (1) LEADERSHIP ROLE, (2) RATIONALE AND NEED FOR TECHNICAL EDUCATION, (3) THE TECHNICAL EDUCATION STUDENT, (4) ADMINISTRATIVE STRUCTURE OF TECHNICAL INSTITUTIONS, (5) PROGRAM PATTERNS AND CURRICULUM DEVELOPMENT, (6) FACILITIES AND EQUIPMENT, (7) STAFFING, (8) FINANCING EDUCATION PROGRAMS, (9) SUPERVISION AND INSERVICE EDUCATION, (1) ESTABLISHING RESEARCH, AND (11) PUBLIC RELATIONS. REPRESENTATIVE PRESENTATIONS FROM SELECTED AREAS WERE--(1) "THE LEADERSHIP ROLE," (2) "RATIONALE AND NEED FOR TECHNICAL EDUCATION," (3) "THE ADMINISTRATOR'S ROLE IN PROVIDING SUPPORT FOR EFFECTIVE FACULTY-STUDENT DIALOGUE," (4) "IMPLICATIONS AND IMPACT OF THE VOCATIONAL EDUCATION ACT OF 1963," AND (5) "STAFFING." VT 002 530, VT 002 936, AND VT 002 930 CONTAIN ADDITIONAL INFORMATION ON THE INSTITUTES. (HC)

Compilation of TECHNICAL EDUCATION INSTRUCTIONAL MATERIALS



Supplement II
INSTITUTE PRESENTATIONS

NATIONAL LEADERSHIP DEVELOPMENT INSTITUTES in TECHNICAL EDUCATION 1966

THE CENTER FOR VOCATIONAL AND TECHNICAL EDUCATION / THE OHIO STATE UNIVERSITY
980 KINNEAR ROAD / COLUMBUS, OHIO 43212

The Center for Vocational and Technical Education has been established as an independent unit on The Ohio State University campus with a grant from the Division of Adult and Vocational Research, U. S. Office of Education. It serves a catalytic role in establishing a consortium to focus on relevant problems in vocational and technical education. The Center is comprehensive in its commitment and responsibility, multidisciplinary in its approach, and interinstitutional in its program.

The major objectives of The Center follow:

1. To provide continuing reappraisal of the role and function of vocational and technical education in our democratic society;

2. To stimulate and strengthen state, regional, and national programs of applied research and development directed toward the solution of pressing problems in vocational and technical education;

3. To encourage the development of research to improve vocational and technical education in institutions of higher education and other appropriate settings;

4. To conduct research studies directed toward the development of new knowledge and new applications of existing knowledge in vocational and technical education;

5. To upgrade vocational education leadership (state supervisors, teacher educators, research specialists, and others) through an advanced study and in-service education program;

6. To provide a national information retrieval, storage, and dissemination system for vocational and technical education linked with the Educational Research Information Center located in the U. S. Office of Education;

7. To provide educational opportunities for individuals contemplating foreign assignments and for leaders from other countries responsible for leadership in vocational and technical education.

COMPILATION OF TECHNICAL EDUCATION INSTRUCTIONAL MATERIALS

SUPPLEMENT II
INSTITUTE PRESENTATIONS

NATIONAL LEADERSHIP DEVELOPMENT INSTITUTES
in
TECHNICAL EDUCATION

SUMMER 1966

Compiled by

C. J. Cotrell
and
I. E. Valentine

THE CENTER FOR RESEARCH AND LEADERSHIP
DEVELOPMENT IN VOCATIONAL AND
TECHNICAL EDUCATION

The Ohio State University
Columbus, Ohio 43212

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PREFACE

In the summer of 1966, 195 leaders and potential leaders in technical education, representing 46 states and Puerto Rico, participated in five National Leadership Development Institutes in Technical Education. The institutes were conducted by the following institutions and directors to whom we are very grateful: Colorado State University, H. L. Benson; Oklahoma State University, Maurice W. Roney; Rutgers - The State University, Milton E. Larson; The University of Florida, E. L. Kurth; and The University of Illinois, M. Ray Karnes. The national consortium of five cooperating institutions was coordinated by The Center for Vocational and Technical Education, The Ohio State University.

The coordinating institution prepared several types of materials for use as instructional resources in the institutes. An original Compilation of Technical Education Materials was prepared in April 1966. Experience in the institutes and the project evaluation, however, revealed the need for additional instructional materials for use by the participants and institute staff for conducting future state and locally sponsored leadership training. To fulfill this requirement, new and revised instructional materials have been developed and incorporated in supplements to the original compilation.

Supplement II is a compilation of presentations and summaries of presentations by outstanding authorities in education who were consultants for the five institutes.

Recognition is due for the following staff members who prepared this document: Calvin J. Cotrell, Specialist and Director of the Project; Ivan E. Valentine, Consultant and Coordinator of the Project; David L. Larimore, Research Associate; and Betty Diehl, Secretary, The Center for Vocational and Technical Education.

Credit is also extended to the following persons who served as reviewers of this publication: Dr. Franklin Keller, Consultant, Vocational and Technical Education; and Drs. A. J. Miller and Harry Huffman, Specialists, The Center for Vocational and Technical Education, The Ohio State University.

Robert E. Taylor
Director

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INTRODUCTION

The materials presented in Supplement II represent a wealth of information on Technical Education which heretofore has not been available under a single cover. These presentations and summaries of presentations by outstanding authorities in education, who were consultants for the 1966 National Leadership Development Institutes in Technical Education, have been compiled as part of the additional instructional materials development effort recommended by the project evaluation committee.

The compilers are grateful to the following institute recorders for their outstanding services in collecting and summarizing the institute presentations:

Jack Annan - Colorado State University

James E. Gallagher - University of Illinois

John Moullette - Rutgers - The State University

E. B. Moore - University of Florida

Scott Tuxhorn - Oklahoma State University

Supplement II is divided into 12 parts and consists of selected presentations and summaries from the five institutes. Parts I through XI contain materials from the University of Florida, the University of Illinois, Oklahoma State University, and Rutgers - The State University, which have been arranged in alphabetical order by the major topics of content offered in the institutes. The institutional origin of presentations is indicated at the bottom of the first page of each paper. The name of the institution is placed after a double asterisk.

A summary of the presentations from the Colorado State University constitutes Part XII. The recorder for this institute summarized his interpretations of the presentations and, therefore, has not cited each presenter. The summary is organized by major topics of the institute program.

While we believe all materials contained in this publication have been developed with great care, it should be mentioned that some of the papers were prepared from tape recordings and are, therefore, subject to transcription error.

The compilers are hopeful that this publication will be a valuable resource in future leadership development programs in Technical Education.

C. J. Cotrell
and
I. E. Valentine

PART I

LEADERSHIP ROLE AND CHARGE

THE EMERGING THEORY OF LEADERSHIP
by
Willis A. LaVire*

The mood of man is changing. His ego is being restored by philosophy and psychology as a result of his enlightenment. His quest for self-realization and self-determination will not now be satisfied by outmoded models. With these great forces to support him, he is demanding a greater voice in his destiny, and he will have it. A newer theory of decision-making and leadership has had to emerge in answer to this demand, and it might be added that this theory is still emerging.

The democratic, or emerging, theory of leadership is based upon assumptions more nearly in accord with man's developing confidence. These assumptions are: (1) that leadership is not confined to those holding status positions in the power echelon; (2) that responsibility, as well as power and authority, can be shared; (3) that everyone affected by a program or policy should share in decision-making with respect to that policy; (4) that the line and staff organization is exclusively for the purpose of dividing labor and implementing policies and programs developed by the total group affected; (5) that the individual finds security in a dynamic climate in which he shares responsibility for decision-making; (6) that evaluation is a group responsibility; (7) that good human relations are essential to group production and the meeting of the needs of the individual members of the group; (8) that unity of purpose is secured through consensus and group loyalty; and (9) that maximum production is attained in a threat-free climate.

It can be seen that although traditional theory is perfectly satisfied by a line and staff organization which determines and also executes policy, the requirements of emerging theory are not met. Something else is needed because the line and staff organization does not provide for equality in decision-making on goals, programs, and policies. The emerging theory really calls for two types of organization within the same institution--one for determining goals, policies, and programs (policy decisions), and the other for implementing policies and programs (executive decisions). Emerging theory accepts the line and staff solely for the purpose of implementing policies and programs developed by the total group concerned.

Democratic theory does not embrace any of the following assumptions:

1. That all decisions must be shared. Many decisions, implementing ones, are individual.

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**University of Florida.

2. That the official leader never tells anyone he must do anything. He is responsible for enforcing policy.

3. That official leadership never takes a stand. He has as much responsibility for stating his position as anyone else.

4. That the amount of time available should not affect the decision-making procedure. Emergency decisions may limit discussion and degree of consensus.

5. That the official leader should not go ahead and make a decision if the group refuses to participate. Extend the opportunity and continue to do so, but do not stop action because no one wants to participate.

6. That insisting that group members work out agreements for good of group is undemocratic. The leader has the responsibility for preserving the life of the group and must fight to do so.

7. That authority is not to be used. For service of the group, not for individual aggrandizement.

It has occurred to me that the line and staff was devised for the purpose of unifying effort in the name of achievement, whereas the effect, by denying participation, might well be a coerced effort which could well be adverse to achievement.

In essence, to me, man is demanding that those who would practice leadership in the decision-making process must first be those who have sufficient faith in man to dedicate their leadership to the release of man's potential. To the school administrator, this means that he who leads best is he who can most fully release and utilize the potential of those with whom he is associated.

Man is saying that his valued participation in policy decisions is the only source for his freely given support toward policy implementation. To the school administrator, this means that if he really expects to achieve efficiency in the realization of objectives, he had better pay heed.

To me, man is saying more. He is saying that diversity should be valued, for through diversity, he is able to foresee more clearly the consequences of his decision, and this is a direct appeal to increase the intelligence which is brought to bear on the decision. To the school administrator, this means there are benefits to be derived, simply by using that which democratic man professes to cherish.

To me, man is saying that he wants his experiences to be such that he will learn to function independently in his approach to problem-solving.

To the school administrator, this means that the dependency-creating experiences found in the authoritarian climate are inappropriate.

And to me, man is asking that he be permitted to learn how to live together for he is anxious to enjoy his evolving identity. To the school administrator, this means that the only positive means yet invented for resolving conflicts is found in the democratic process.

In conclusion, I hope that it has been demonstrated in this discussion that man is once again on the move. Increased intelligence is powering this move--this time in the direction of self-direction. He marches with confidence for he has received the supreme compliment of being placed in charge of his fate. This charge requires that he have a voice in the decisions which affect him, and have it he will. The authoritarian decision-making method has tradition as its champion, but so had the horse and buggy and James Whitcomb Riley's "Outhouse."

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THE LEADERSHIP ROLE
by
Ralph C. Wenrich*

Leadership is based on communication. Communication is facilitated as we come to know each other's conditions and problems. Communication often breaks down because we do not know and understand the problems and concerns of those with whom we are attempting to communicate.

In determining what leadership is and how a leader is recognized, several authorities were consulted. Webster's International Dictionary defined a leader as:

> A person.....who precedes or directs in some action, opinion or movement.

Ordway Tead defined leadership as:

> The exercising of influence over others on behalf of the leader's purposes, aims or goals. Leadership.....has the more difficult task of being concerned with what the followers should want, may come to want, or be brought to want.....

The difficulties of defining leadership are illustrated by Cartwright and Zander:

> .....leadership is a property of a group while to others it is a characteristic of an individual. (In).....the group, leadership may be synonymous with prestige, with the holding of an office, or with the performance of activities important to the group. (In).....the individual, leadership may mean the possession of certain characteristics such as dominance, ego-control, aggressiveness, or freedom from paranoid tendencies, or.....the possession of certain physical characteristics such as tallness, or an impressive physiognomy.

Leaders cannot be distinguished from non-leaders simply on the basis of personality characteristics or traits.

Admiral Rickover--lampooning the military habit of defining leadership by certain rules of conduct--said:

> Such rules are not the basic essentials of leadership. There is more to it than that.

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**Rutgers - The State University.

The author of Seven Days in May describes leadership as:

> That mixture of good will, force and magnetism.

There is reason to believe that in certain situational contexts, specific traits of individuals may be associated with their leadership. Darley, in 1961, said:

> .....it has become fashionable to define leadership as related to situations and as relatively uninfluenced by individual traits.
>
> More attention.....of group behavior in leadership should be given to the interaction of individual traits and situational factors.

In support of the interaction theory of leadership, Gibb said:

> Any comprehensive theory of leadership must incorporate and integrate.....major variables.....know to be involved, namely: (1) the personality of the leader, (2) the followers' attitudes, needs, and problems, (3) the group .....(in) regards to (a) structure of inter-personal relations, and (b) syntality (sic.) characteristics, (4) the situations.....physical setting, nature of task, etc. Furthermore.....it will not be these variables per se which (will) enter into the leadership relation.....it is the perception of the leader.....the leader's perception of those others, and the shared perception.....of the group and the situation with which we (will) have to deal.

We are concerned with leadership in large formal organizations..... not all leaders.....are in administrative and/or supervisory positions. And.....not all persons in administrative and supervisory positions are .....leaders.

James M. Lipman analyzed the difference between leadership and administration:

> In examining the organizational setting.....we can conceive (it) as a hierarchy.....a structured social system. This hierarchy of relationships serves.....to achieve the goals of the organization. A social organization..... exists to discharge certain functions.....or ends toward which the (organizational) behavior is directed.
>
> The important analytical and conceptual unit of the sociological dimension is the role: the dynamic aspects of positions, offices, and statuses.....Roles are defined in terms of expectations.....Roles are also complimentary and interdependent.....The school system is structured in terms

of such complimentary roles as board members, superintendents, directors of vocational and technical education, principals, teachers, and pupils.

In terms of the psychological dimension, an organization is always interpersonal.....

To understand and predict social behavior, we must take into account the need.....of the individual as well as the structure of the organization.

The two dimensions--sociological and psychological--are related to organizational effectiveness and efficiency.

Leadership, in this context, implies the initiating of a new structure of procedure.....The emphasis is upon initiating change.

The administrator.....may be identified as the person who utilizes existing structures or procedure...., The administrator is concerned with maintaining.....established structures.

There has been some research dealing with general school administration.

One study showed that principals, judged to be effective, exhibited the following characteristics: (1) engaged in strong, purposeful activity; (2) related well to people; (3) sought success and higher-status positions; and (4) felt secure in both home and work settings. On the other hand, principals, judged to be ineffective, were: (1) deliberate in nature; (2) satisfied by present status; (3) preferred assisting children to working with teachers; (4) depended on others for support; (5) showed strong emotion in charged situations; and (6) showed preoccupation with speculative reasoning.

Gross and Herriott attempted to measure Executive Professional Leadership (EPL)--defined as "the effort of a principal to conform to a definition of his role.....to improve the quality of staff performance"--of elementary school principals.

They found that the effective principal had a high evaluation of his ability to provide educational leadership to his staff, devoted off-duty time to his job, had a service motive for seeking positions, possessed intellectual ability, and commanded interpersonal skills.

They also found that effective leaders permitted teachers to share in decisions, treated teachers as equals, gave teachers social support, offered teachers managerial support, and supported teachers in conflicts with pupils.

Other studies.....dealing with large formal organizations.....identified two major dimensions of leader behavior: (1) initiating structure

in interaction, i.e., (a) delineating leader-follower relationships, and (b) establishing clear organizational goals and procedures; and (2) consideration, i.e., warmth in relationships.....

.....a person who rates high in these two dimensions.....is generally perceived to be more effective than one who rates lower.....

Cartwright and Zander pointed out that most group objectives may be accomplished under two headings: (1) activities directed toward the attainment of stated group goals; and (2) activities directed toward maintaining or strengthening the work group.

Kinds of leadership behavior in the first are: keeps interpersonal relations pleasant; arbitrates disputes; provides encouragement; recognizes the minority; stimulates self-direction; and increases the interdependence among members.

Kahn and Katy.....claim that some supervisors are production-oriented while others are employee-oriented. The former emphasize increased efficiency, and institutional goal attainment. The latter focus on employee motivation.....and the building of employee morale.

The 1963 University of Michigan Leadership Development Program in Vocational and Technical Education attempted to identify.....and develop persons for leadership roles.....and to find out how one can identify potential leadership and to learn.....what constitutes a sound program for the development of (these) persons..... Heretofore, most (vocational) teachers were recruited into the profession on the basis of technical competency and rose to positions of leadership without acquiring an understanding of our society. They need this understanding and to develop the skills and abilities of effective leaders.

The results to date of the University of Michigan project indicated that nearly two-thirds of the men in the project summer workshop and internship had moved to more responsible positions.

Effective leadership in vocational and technical education is characterized as follows:

1. The.....leader helps others to accept common goals.
2. The.....leader initiates productive action in group situations.
3. The.....leader establishes clear plans and work procedures.
4. The.....leader maintains warm relationships.....
5. The.....leader obtains commitment and cooperation from those with whom he works.
6. The.....leader effects change and builds organizations.....

Vocational and technical education.....must take new directions..... The leader can be expected to succeed only if he knows how to work with people.....

THE LEADERSHIP ROLE

by

Robert R. Wiegman*

For some time, we thought of leadership in terms of giving orders and directing the activities of others. If one aspired to be a leader, there were certain leadership traits which either had to be inherent or developed. Then we began to see that perhaps leadership was situational--fluctuating from one person to another in any given group, diffused and based upon the task at hand.

Then research on leadership began to use two different terms, one, "status leader," and the other, "emerging leader."

The status leader is one who owes much of his authority to the position he holds. He may be a president, a dean, or a colonel. His position gives him status. He is followed with various degrees of enthusiasm, depending upon how he exerts his leadership qualities. He senses the direction in which the group should move and proposes courses of action to move the group in that direction. His leadership is accepted as long as the group is moving forward toward the stated objectives. When he fails to be in the forefront, the group turns elsewhere for leadership. To reinforce his leadership, he gathers around him men and women who are also ambitious, who like power and authority, and who are willing to subordinate their own personal ambitions and ideas about institutional goals to the person whose leadership they have accepted.

Emerging leadership is based upon the acceptance and symbolizing of group goals. Emerging leaders are able to put into words the aspirations and dreams and fears of the group around them. They express in words what others are thinking but are reluctant to express. They take their strength from the groups; their leadership is accepted. They are the common denominator, the voice. These are the people who speak up in departmental and faculty meetings. They are substantial members of the faculty, and we should tap their abilities. They have much to contribute, but they can be frustrating people to have around. They are rather easy to identify--they speak out, are good committee members because they are willing to serve, and they are the people to whom others listen and with whom they visit and talk.

Leadership is based upon one overwhelming conviction: a deep faith in people. As educational leaders, we expect the staff to do the right thing. The problem is one of determining what the right thing is. Unless we have a clear understanding of our goals as an institution, how can we measure the extent to which we have progressed. These goals must be established in concert with the staff in order that the institution's

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goals coincide with the goals of the individual staff members.

Once the direction has been agreed upon, we, as leaders, must have faith in the subordinate's determination to reach the goal and believe that his determination is just as strong, as sincere, and as deep as our own. If we have this faith, there are several considerations which can assist us in functioning as effective leaders. These are:

1. We should have a sincere desire to develop others.

2. We should recognize leadership in others and release it.

3. We should be mature people.

4. We should value differences and see growth as a result.

5. We should involve people in policy formulation as well as policy execution.

6. We should examine ideas on their own merit, regardless of who advances them.

7. We should develop a sound organizational pattern wherein each member understands his role and authority, as well as the role and authority of others.

8. We should eliminate petty, unnecessary activities to permit the staff to engage in thinking and planning.

9. We should encourage experimentation and innovation by active support and interest.

10. We should understand and care about the program of the entire institution.

11. We should accentuate the positive in our relations with others. Keep posted on what happens to your staff. Compliment good work; recognize important events in the personal lives of your staff.

Chris Argyris, reporting in the March-April issue of the Harvard Business Review on a study of the gap which often exists between what executives say and how they behave, offers some courses of action which may be appropriate in developing more effective educational leadership:

1. The executive can strive to be aware that he is probably programmed with a set of values which cause him to behave in ways that are not always helpful to others and which his subordinates will not discuss frankly when they believe he is not being helpful.

2. The executive should not accept group ineffectiveness as part of life. Groups can be effective, and the value of a group is to maximize individual contributions. One of the main tasks of the leader is to build and maintain an effective decision-making network; therefore, he has no choice except to spend time in exploring how well his group functions.

3. A good technique is for the leader and his group members to tape record a decision-making meeting, especially one which is expected to be difficult; and later on the group members can gather and listen to the tape. This in itself is an education.

Argyris concludes by saying that he had never observed a group whose members wanted it to decay. He had never studied a group or organization that was decaying where there were not some members who were aware that decay was occurring. Accordingly, he points out, one key to group and organizational effectiveness is to get this knowledge out into the open and discuss it thoroughly.

To me, these are some of the factors that are necessary for effective leadership.

PART II

THE RATIONALE AND NEED FOR TECHNICAL EDUCATION

THE RATIONALE AND NEED FOR TECHNICAL EDUCATION

by

Abraham J. Berman*

A three-year survey of technical manpower was recently completed in New York State. A study of this group of occupations was made because: less was known about this group of occupations than about any other; these occupations had expanded most rapidly during the 1950's; this group could offer a great many job occupations to young people during the 1960's; technical institutes and the vocational-technical high schools needed up-to-date information in order to know in which technical fields to expand offerings and in what sort of facilities to invest; it was necessary to learn what type of personnel and what type of training industry wanted; and because the employment service, guidance counselors, curriculum developers, and technicians could use information on the nature of these jobs, the skills required, and the opportunity for employment and advancement within this group of occupations.

From 1947 to 1965, the civilian labor force rose from 60,000,000 to 76,000,000. In the 16,000,000 gain, 6,000,000 were men while 10,000,000 were women.

The total labor force is expected to increase to 101,000,000 by 1980. About 13,000,000 of the gain will be men and 10,000,000 will be women. The largest gains will occur among the youngest workers--those from fourteen to forty-four years of age.

During the recent past, the largest increases in employment have occurred in service-producing industries. In the future, the largest gains are expected in the trade, service, and government sectors of the economy.

Employment for professional and technical workers between 1965 and 1975 is expected to gain by 48.6 percent. Above average increases are expected among clerical and service workers. Growth should be relatively low for operatives, and in the next decade, there should be a decline in the number of industrial laborers, farmers, and farm managers. This indicates that there is a greater need than before for post-high school education in the technical and professional fields on the part of youth.

Industry has begun to worry about recent structural labor shortages, stemming from the upward shift in skill requirements. The number of jobs may dwindle because of increasing technological change; nevertheless, structural labor shortages in engineering, management, and skilled jobs

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will become more of a problem. What is needed is continuing job opportunities for the expanding younger and older groups, with particular emphasis on increased training for youngsters.

In the New York State Labor Department's survey of technicians, the most difficult problem was to define a technician. It was broadly concluded that a technician is one who works in private industry or a public agency in a job intermediate between that of a craftsman and that of a professional scientist or engineer who needs mathematics beyond simple algebra and science beyond the typical general science course.

In New York State--within this definition--there are as many technicians as there are scientists, mathematicians, engineers, and architects. Some professionals are supported by several technicians while others have no technical assistants.

Engineering education is putting more emphasis on theoretical research and development aspects and far less on the practical aspects. The true economy calls for every engineer to be supported by four technicians. This 4:1 ratio is greater than the existing 1:1 overall ratio.

Job descriptions for the technical occupations are difficult to define. In New York State, there exists a detailed classification scheme consisting of fifteen broad groupings and several hundred minor groupings. These are further divided into product and equipment categories and also into function categories, i.e., design, development, installation, maintenance and trouble-shooting, and combinations of these functions.

The survey produced these projections: in New York State, by 1975, there will be approximately 228,000 technical occupations (this figure combines the effects of the changing and expanding industry structure with estimates obtained from employers on the expected increasing proportion of technicians to all the other employees in their establishments); The largest increases in technicians will be in the medical and biological field; services of technicians will be used more extensively than in the past; employers will supply additional support personnel for scientists and engineers in order to better utilize the latter; research and development will continue to expand; and automatic laboratory, testing, and other equipment will replace some low-level technical help which will expand the need for other technicians to develop, operate, and maintain this equipment.

Growth will continue in the computer industry for the processing of data, for the space industry, and for advances in the automation of production. As late as 1950, there were practically no programmers in New York State. By 1975, it is expected that there will be 10,000 such jobs in the Empire State.

Today, there are many opportunities for technicians in jobs related to the construction industry such as draftsman, estimator, surveyor, and

structural designer. If the expected expansion of industry takes place, persons in such jobs should prosper. A young person looking for a technician job will find openings not only because the total number of such jobs is growing, but also because people now in technicians' jobs will die, retire, be upgraded, or shift to other occupations. The latter opportunity is unusually good because a technician's practical experience and science orientation open up new challenges in high management positions.

The overview of job opportunities in the technician field indicates that graduates of two-year technical programs should find little difficulty in obtaining good jobs in the future.

The mentioned survey and its results caused teachers of technical subjects to: make contact with employers; examine carefully the nature of technical jobs; learn the knowledges and experiences expected of future technicians; identify new laboratory equipment used by industry; learn what occupations were expanding, declining, or remaining static; justify the continuation of some programs, the dropping of others, and the adding of new ones; and to rearrange programs relative to emphasis on design, development, maintenance, and trouble-shooting.

Training engineers to be a bit more theoretical and a bit less practical is leaving a gap in the structure of industry. Within this gap is much of the work that engineers did in the past. A great deal of it is being taken over by persons who are technically trained.

Whether it is better for a student to learn specialized techniques in school or on the job was a question not resolved by the survey.

The main value of the New York State survey appears to be that some light has been thrown on the number of different sorts of technical jobs; their importance; their nature, characteristics, and variety; their requirements; and the trends under way in this field.

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THE TECHNICIAN AND HIS JOB

by

Lynn A. Emerson*

In achieving the goals in technician education--and in other education as well--we are faced with the task of changing the behavior of persons. In this sense, we define behavior as the composite of how persons act in their work life. This behavior is determined by the nature and quality of their knowledge and understanding, their skills and abilities, their attitudes and appreciations. An educational program for technicians must take into account the needs of workers in technician jobs with respect to these attributes. In planning programs, we must look, not only at the present job of the technician, but also at the jobs of tomorrow.

The rapidity of technological change indicates that the person entering the labor market today may be forced to make several major job changes during his lifetime. Our task thus includes his preparation for initial entrance into work life, and also such preparation for change as may be feasible to include in the program. Perhaps one of the larger tasks is that of developing proper psychological attitudes toward change, of facing change effectively. This will involve continuing study for growth and updating in the initial job, and in other jobs growing out of the initial job, and possibly a major shift into some new occupation that will emerge due to technological advancement.

An educational program that helps persons prepare for changing conditions needs breadth, and it needs attention to those bodies of content that cut across all occupations. Perhaps human relations and industrial economics should be given greater attention, as well as breadth in basic science and mathematics; and it probably will not be long before every technician curriculum will include at least a basic understanding of the functions that computers will play in the world of tomorrow.

In trying to get at a clear understanding of the present-day jobs of technicians, the charts we have to present may be of help. The first of these shows a comparison of the semiskilled worker, the skilled craftsman, the technician, and the engineer with respect to the division of their total task between manipulative and technical skills. You will note that the four sections of the chart form a continuous series, with the proportion of the technical skill of the semiskilled worker rising in certain types of such jobs to that of certain skilled craftsmen, the craftsman shading into that of the technician, and the technician into that of the engineer. You will note also that within each category are different proportions of technical and manipulative skills--some craftsmen

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requiring more than others, and some technicians differing from other technicians. In comparing the craftsman and the technician, a rough measure is, when the total technical effort of the worker exceeds 50 percent of the total effort, he might be classed as a technician.

The variations of technical and manipulative skills among the different skilled craftsmen are rather wide. Some craftsmen, such as toolmakers and printers, require a much wider range and amount of technical skills than do other craftsmen such as plasterers or bricklayers. The manipulative skills required of such craftsmen may be very high--for example, the plasterer.

It is difficult to draw distinct lines between jobs and to say that one job is in the technician category and another in the skilled crafts; but we can draw broad lines, and for convenience we group the jobs somewhat as shown in the chart. When legislation confines the use of funds to specific groups, such as N.D.E.A. funds allocated to the training of technicians, jobs must be classified; but the Vocational Education Act of 1963 makes it possible to transfer funds from one category to another, and this does away with the need for some of the fine classification of jobs.

Some occupations in the vocational-technical field are very limited in the amount of technical skill required and the range of content with which they deal. Others require that the worker deal with a considerable variety of subjects and have a high degree of scientific understanding and technical skill. The chart showing types of technical occupations illustrates these differences. At one end of the scale are the jobs of low level and narrow scope, such as routine inspection or routine engine testing. They have some technical content but can hardly be called technician jobs. Other occupations have a narrow range of technical content but demand a high level of technical ability within that range of content. Such jobs might include the servicing of color television receivers. Such workers might be classified as technical specialists.

Other technical occupations require a moderate level of ability and understanding of a moderately wide scope of content. The production technician who deals with quality control, production control, and the like, might be listed in this category, sometimes referred to as the industrial technician. The category which includes jobs which demand a high level of scientific and technical ability and acquaintance with a wide range of content, embraces the different types of engineering technicians. These persons must be able to work with engineers in a wide variety of situations. They usually need more mathematics and science than do the industrial technicians. Such jobs as tool designer, engineering aide, and electronics technician are in this category.

In some educational institutions, provision is made so that students who for one reason or an other don't fit into the engineering technician curriculum are given specialized instruction in a narrow field and thus

trained as technical specialists rather than technicians.

In looking at the different types of technical occupations--from the low-level technical jobs to those of engineering technicians--the question may be raised as to how these jobs differ from those of the skilled crafts. As noted earlier, many skilled crafts border on technical occupations, and jobs formerly classified as skilled crafts may now be considered as technician in character because of the great increase in technical content required for such jobs. There is also the temptation to put undue emphasis on the training of technicians and to neglect the training of skilled craftsmen. The number of skilled craftsmen greatly exceed the numbers of technicians, and the need for their training is great. The high rate of increase in technician jobs due to technological change is responsible for our present increased interest in the development of technician training programs, and this will probably continue for some time.

As one looks at the various stages which a product goes through from its inception to its ultimate use--as listed in the chart--and notes the types of workers that have to do with each stage, it is evident that the technician is concerned with all of them. He assists the scientist in the research aspects and the engineer in the design, development and testing. He deals with various aspects of manufacture. The technical salesman is often a technician. He is concerned with the installation of complicated technical equipment and with its operation. He is called upon to maintain the product in operating condition through technical service.

If one looks at the technician jobs in the construction field, as shown in the chart, he finds a considerable variety. The skilled crafts jobs in this field include the bricklayer, plasterer, carpenter, painter, electrician, etc. The technician jobs include the architectural draftsman, estimator, building inspector, equipment salesman, surveyor, expediter, specification writer, and the like. Some of the technician jobs require a background of experience in one or more of the skilled crafts; others require broad technical training.

In the field of manufacturing, there are many jobs of technician character. The skilled crafts jobs in manufacturing include the machinist, molder, toolmaker, patternmaker, maintenance electrician, etc. The technician occupations embrace such jobs as the tool designer, mechanical draftsman, tool inspector, time-motion study man, expediter, technical maintenance man, technical supervisor, and the like. Some of these technical jobs vary considerably in scope and level. Some draftsmen do relatively simple work; others are concerned with highly complicated tasks of basic design. Some inspection tasks are simple; others such as surface plate inspection of complicated tools, gages, and fixtures are quite difficult. The tool designer needs to know toolmaking and various phases of machine tool production processes, as does the tool inspector. Likewise, the technical supervisor needs a broad

understanding of the machinery, processes, and materials of the area in which he works.

As one looks at the greatly varied types of technician jobs, it is interesting to note that inspection techniques--diagnosis of situations and judgment with respect to the observations--are found in a high proportion of technician jobs. The techniques of diagnosis--analysis and synthesis--are thus important elements of technician training programs. Another important element that cuts across all technician jobs is that of communication--of transmitting and receiving information through all sorts of ways.

One way of differentiating between technician and skilled crafts jobs is by using a check list showing characteristic technician tasks. If the majority of the items are found in the job under consideration, it may well be classified as in the technician category. Some of the items in the check list are as follows: analysis and diagnosis of situations involving technical understanding; ability to use standard technical handbooks; the use of a variety of instruments; interpretation of plans and drawings; visualization and creative design; understanding of materials and processes in the special field, and the like. Not all technician jobs involve all of the elements in the check list, but they are useful as criteria in identifying technician jobs.

Technicians are found in a wide variety of occupational fields. The medical and health fields require many technicians. They are found in agriculture, in business offices, in the distributive field, and elsewhere. In the years ahead, we shall probably see considerable expansion of educational programs for technicians in fields outside industry.

Over the years, we have seen many programs developed for mechanical technology, electrical-electronics technology, civil technology, and the like. Great expansion has taken place in the data-processing field. Now we are beginning to see the development of programs that cut across traditional categories. The field of electro-mechanical technology is emerging. Previously it was necessary--in preparing persons for certain jobs in this field--to take a person with mechanical technology training and give him some electronics or vice-versa; but neither of these practices proved to be entirely satisfactory. We are now in the process of developing integrated curriculums, involving pertinent aspects of both technologies. This may well happen with other technologies as well.

May I call attention to the desirability of program planning for technician education on a state-wide basis. In developing a master plan for technician education for a state, one must recognize that technicians have mobility and that the placement market for graduates of an institution may extend beyond the state borders; but it must also be kept in mind that courses for employed workers must be available. Thus the programs must be made available in such fields, in such quantities, and

in such locations as will meet the needs. In certain occupational fields, perhaps a single educational program is all that is needed to provide for the state as a whole; in other fields many programs will be required. Decision with respect to the types and numbers of programs needed for the immediate future, where these should be located, and priority in their development are sufficiently important to warrant the expenditure of time and money in developing such a state-wide master plan.

The rapidly developing technology is causing great changes in many different occupations, including the semiskilled as well as the technician. The overall program required to meet all these changes goes far beyond anything we have at present. Vast changes and much expansion are needed in our programs of occupational education if the labor market needs of tomorrow are to be met. The logical place for much of this expansion lies within the framework of public vocational-technical education. If this agency does not rise to meet the needs, perhaps other agencies will be called in.

EFFECTIVE TECHNICAL EDUCATION
by
ROBERT M. KNOEBEL*

Effective technical education produces graduates who are capable of entering one or more of a group of occupations requiring scientific knowledge and skills; who are able to progress rapidly on the job; who are able to successfully pursue additional course work; and who are able, because of their educational experiences, to practice desirable citizenship in the home and community.

The advent of "Sputnik" caused technical educators to emphasize specialized subject matter necessary to support professional personnel; and the National Defense Education Act (NDEA), including Title VIII, encouraged the shift from "doing" to "thinking and doing."

The 1965 Massachusetts Institute of Technology Summer Study report indicates a continuation in this direction. It recommended:

> .....that there be initiated a program of development of new curricular patterns and instructional materials for all students beginning with the start of junior high school.....these new patterns and materials propose to utilize the potential of experimental and investigative activity as a spring board to the acquisition of skills, to understanding and to the development of the ability to think.

The successful operation of the economy of our land is dependent upon a cadre of workers content in, and capable of, filling the wide range of occupations; therefore, programs should be developed and operated in keeping with state, national, social, economic, and psychological needs.

Placement of technical education graduates is common, and all information indicates that well-prepared graduates of technical programs are in great demand. Placement is a part of evaluation essential for an effective technical education program as is the determination of how well the technical programs meet the total needs. Consequently, it is important that placement and follow-up records are maintained.

Characteristics essential for effective technical education in high schools are: programs begin not later than the tenth grade; school days contain seven or eight periods per day; and students are selected from the upper 50 percent. In junior or community colleges, the characteristics

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are: the administration understands, supports, and places technical education on a par with college transfer programs; the general education values of specialized subject matter courses and related courses are recognized; and the curriculum provides 50 to 60 percent of time for specialized subject matter, 15 to 25 percent for mathematics and science, 10 to 15 percent for auxiliary courses, and 10 to 15 percent for general education.

Effective technical education must be based upon the knowledge and skills essential for those occupations supporting professionals. Adequate time--approximately 1,000 clock hours--must be allotted to specialized subject matter. Additionally, the administration, particularly in a comprehensive institution, must understand and fully support the technical education program; and placement opportunities and follow-up studies of graduates must be provided and conducted.

RATIONALE AND NEED FOR TECHNICAL EDUCATION
by
E. L. Kurth*

The population of the United States and the changes in it effect education and the role education must play in the lives of all people. Some of the changes which will affect education, and especially programs in all occupational education, have occurred in the last five years.

The trend is toward a much more educated people. The average high school graduate today will complete more than twice as much education as his parents had. The fall of 1965 saw 54 million people in school in the U. S. This was one-fourth of the total population. By 1985, it is estimated that one-half of our total population will be in school.

Of the 54 million persons in school in the fall of 1965, there were 12.7 million in high school. That spring there were 2.3 million high school graduates, or an increase of 93 percent since 1955. It is estimated that 71 percent of the seventeen-year olds in school today will graduate from high school, and 30 percent will enroll in college.

In the employment picture in the past decade, there has been a 40 percent increase in jobs for high school graduates and a 10 percent decrease in jobs available for those without high school education. It is estimated that those with a high school education will earn, in their lifetime, $100,000 more than those with only eighth grade education. Those who graduate from college will earn $400,000 more.

The labor force of the nation is considered to be all those people who are capable of earning their living by working, including the unemployed. The work force is considered to be those who, over a major part of any year, are actually employed.

At current levels, the average American male enters the work force full-time between his eighteenth and nineteenth birthday. Today, the average young man of twenty can expect another fifty years of life spent as a worker and seven years spent in retirement.

Who, then, in the U. S. civilian labor force is working today? The U. S. Bureau of Labor reported that in July of 1964, there were 70.6 million people working, in July of 1965, some 72.8 million, and in April of 1966, 73.4 million were working with only 3.6 million or less unemployed. In July of 1965, there were 6.4 million teenagers employed or 700,000 more than in July of 1964. Of our non-white population, 7.7 million or 810,000 more were employed than in 1964. There were 22.8 million women employed or one million more than in 1964. Factory workers numbered 18.1 million,

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up 800,000 over the previous year. The total of non-agricultural workers was 61.1 million.

From 1961 to 1965, industry provided some six million new jobs which were not in existence before, with only a small percentage of new jobs provided by government programs. Indeed, with the decrease in the birth-rate from 23.4 per thousand in 1958 to 19.3 in 1965, there is concern that the increase in Gross National Product will slow down in the future because of lack of workers. This is in stark contrast to the predictions that with automation taking over, from 2 to 10 percent of the work force could do all of the necessary production and services of the nation; and the society and economy would have to devise something of an educational or recreational nature to occupy the time of the rest of the people.

In November of 1965, the Bureau of Labor reported that two-thirds of the work force was engaged in service industries and one-third in goods-producing industries. Of the 86 million people in the work force predicted by 1975, women will comprise 30 percent of them. At present, nine million of the women in the work force are in clerical jobs, seven million in service occupations, and four million in factory jobs. The percentage in professional and technical jobs requiring higher levels of education has actually decreased slightly.

The Florida Industrial Commission has reported an interesting rule of thumb as to the effect on a community by an industry which comes in and provides 150 new jobs. The U. S. Chamber of Commerce uses similar figures. One-hundred-fifty new jobs will bring 444 new people into an area. This will mean 168 more households and 111 additional jobs in trades, building, and services. It will also mean 76 more school-age children. For the economy, it will mean $885,00 in increased personal income, $405,000 in bank deposits, and $500,000 in retail sales, including 160 new cars in the community. It will also mean that of the new employees, some 50 will come from the farms in the community.

It is often asked what contributes to or causes the great increase in jobs in industry? It is more than the increase in Gross National Product, although just the increase in the economy accounts for many jobs. Much of the job increase is due to research done to develop, discover, and improve the products and goods we already have. The "research race" is what it is called by many; and it is admitted by almost every nation, including France, that this is a race the United States is winning. Europe has been concerned for some time about the "brain drain" which has been luring some of the best scientists and engineers from their countries to America. From 1952 to 1961, 30,000 engineers, 14,000 physicists, and 9,000 scientists left Germany, France, England, and other western European countries to come to the U. S. A. Research in the United States is said to be its sixth largest industry. In 1965, we spent 20 billion dollars on research. We have 23 researchers per 10,000 population at work, compared to 18 in Russia, and even fewer amounts in all other countries. In 1965, it was estimated that the United States had 800,000 employed scientists, engineers, and technicians in research

and development. The results are, of course, computers, missiles, space satellites, jet airplanes, new products in optics, drugs, biochemistry, bioengineering, synthetics, food, fibers, automated equipment, as well as the hundreds of new appliances considered necessary in our homes, offices, and automobiles. The educational requirements for a researcher are the willingness and ability to learn, solve problems, analyze results, know principles, and apply these to solve new problems.

What about the new areas defined as technology and which require technicians? Some of those identified are as follows:

1. Systems Engineering (mechanical and electronic combined). This involves new developments in power control and the rapidly developing field of fluid power.

2. Automation Engineering Technology (production and manufacturing). This requires new knowledge and skill in dealing with power sources, control mechanisms, and study of the economic feasibility of such developments in manufacturing.

3. Instrumentation Technology (hydraulic and electronic controls).

4. Materials Engineering (new synthetics as well as new uses for materials long used). Metals, plastics, ceramics, gases, liquids, and fibers.

5. Biomedical engineering (instruments and devices).

6. Oceanographic research.

7. Astronautical research and developments.

8. Water use and treatment.

9. Agricultural technology and research.

10. Conservation of natural and human resources/technologies.

11. Municipal works technologies and municipal services.

12. Quality control technology.

These are only a few. For example, in quality control, some large industries engaged in defense work and rocket and missile manufacture employ from one of every six to one of every ten workers as a quality control technician. When reliability of the product is necessary to the seventh decimal place, it is easy to see that the characteristics of technical education are precision, accuracy and reliability.

The American Chemical Society reports in a special "Careers" issue of its weekly magazine, Chemical and Engineering News, that the shortage of chemists and chemical engineers threatening the chemical industry is paralleled by a shortage of chemical technicians who can perform routine laboratory work to free the professionals for more creative work. A company executive says, "I'd hire every technician I could get my hands on." The magazine also reports that the ratio of technicians to professionals is generally higher in production than in research, and cites one production-oriented company which employs over fifteen technicians for every professional in its production department.

The overall need for increasing numbers of technicians and people with an increasing amount of technical education is reflected in the U. S. Bureau of Labor statistics for 1965, which indicate an annual need for about 200,000 technicians and less than 75,000 enrolled in all fifty states in post-high school technical education programs.

The "disaster gap," as it has been called, increases each year unless more qualified people enter the program or the economy expansion slows down or stops; and business, industry, and the society will not permit this latter possibility to occur. Education must provide the qualified people or private agencies will step in to do the job.

TECHNICAL EDUCATION
AT THE HIGH SCHOOL LEVEL
by
Frank Stewart*

Two questions arise in a dialogue on technical education. One is, "What does technical education mean?" and "Who is a technician?"

The study, <u>Technical Manpower in New York State</u>, defines the technician as:

> .....mid-way between the craftsman and the engineer or scientist.

Gray areas exist within the boundaries of this definition. The technician is a person concerned with the daily application of scientific principles and/or one or more aspects of design.

The term "technical education," as applied to secondary education, and also as applied to some institute level programs, is often misused and debased. Very often, programs which are distinctly trade or craft oriented, are mislabeled as technical. In some high schools, industrial arts shops are labeled as technical shops, and some institutes label every shop as a laboratory--the machine shop was called the metal working laboratory. The laboratory is a place where scientific principles are demonstrated and applied, involving: measurement, observation, and report writing based on data collected. The laboratory may also involve the use of industrial proto-type equipment.

Quality technical education at the secondary level has never reached its full potential. When a technical program is given as an adjunct to a trade program in the same building, the best quality students are not always attracted. When pairing of programs is necessary, a stronger technical program seems to result if it is paired with an academic program.

Another deterrent to the expansion of technical secondary education has been the cost of initiating and supporting such programs.

Today, there is a school of thought which believes all specialized education should be deferred to the post-high school years and that early specialization is harmful to the pupils. This is undoubtedly true if we start to train a pupil at the age of fourteen for a specific job that will be non-existent four years later. It is educationally sound to allow the sixteen-year old student to study electronics or architecture, if he is

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motivated and capable, rather than delay it until the age of nineteen or twenty.

The objectives of technical education at the secondary level are:

1. To prepare the graduate for employment in an entry job in one of the major technology areas.

2. To prepare the graduate for admission to colleges of engineering or science.

3. To provide the student with a broad general education which stresses the humanities as well as science, mathematics, and technology, and which provides all pupils with salable skills.

Courses should not be terminal in the sense that the graduate is not prepared or motivated to seek higher education.

The realization of these objectives requires a student body capable of profiting from a quality technical secondary program, a suitable curriculum, competent staff, and an appropriate physical plant.

THE TECHNICIAN AND HIS JOB
by
Fred Thornton*

For the purpose of this discussion, we will assume that we have defined and identified the technician. We have a reasonable idea of the general groupings presently in existence and likely to arise in the near future. My remarks will be primarily from the viewpoint of the employer.

The classification of technicians differs greatly from industry to industry. In research, production, business, and service industries, there are many diversities in job titles, descriptions, and duties of technicians. For example, in production we find technicians engaged in maintenance, installation, servicing, expediting, and other activities, while operating within the general classification of mechanical technician. Jobs and terminologies are changing now and will change even more significantly in the next few years.

The following elements or criteria are frequently used in establishing job descriptions for technic positions:

1. Job knowledge.
2. Personal requirements.
3. Physical application.
4. Job conditions.
5. Mental requirements.
6. Accountability.
7. Direction of others.

Usually, separate descriptions will stipulate beginning employment factors, and others are prepared for more advanced classifications.

Periodically, the performance of technicians is evaluated on the job. These evaluations usually include areas and point values that may be used to determine salary increases and promotion to other jobs. Included are:

1. Job knowledge.
2. Analysis and initiative.

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3. Personal requirements.

4. Accuracy and reliability of work.

5. Responsibility for cost and service.

6. Application--industry and attendance.

7. Leadership.

Jobs requiring technicians are usually classified in term of training received. In large industries, there is a need for training in broad areas, enabling the technician to qualify for a variety of assignments. It is not suggested that the training program be a series of exploratory experiences such as general shop, but rather in the broad areas such as electronics, civil drafting, design, etc. Often industry provides the specific training on particular equipment or processes after the technician is employed and has become familiar with his job. Programs for training technicians should include a common core in mathematics, science, and communications which develops within the individual a potential for growth.

Technician job titles and descriptions are changing rapidly and will continue to do so. It is anticipated that new areas and emphasis requiring technicians will occur in such fields as medicine, social service, mechanics, agriculture, education and training, and safety and plant protection.

Attention should be given to educational services for technicians after employment. Often special needs will develop after the technician is employed, and the educational institution will have an opportunity to be of further service to the technician as well as to maintain a close association with industry.

In conclusion, the following points are offered for consideration:

1. Industry needs technicians trained in occupational clusters to permit flexibility in job assignments within a particular technology.

2. Technicians must be competent in the areas of mathematics and science.

3. Speaking, listening, and writing skills are usually essential if the technician develops fully.

4. Instructional methods and laboratory practice should develop critical thinking skills and ability to see the "whole system" or process rather than isolated stages or individual units.

5. To be successful, the technician must be able to follow instructions and work well with fellow employees.

THE ROLE OF THE PUBLIC SCHOOLS
AND ADULT EDUCATION
by
Ralph C. Wenrich*

It is assumed that every educator is interested and committed to the total development of the individual. It is further assumed that an educator's primary concern is the discovery and the development of human talents as they relate to employment.

These trends are apparent in the role of education: (1) changes in our society place a major responsibility on the school to prepare people for work; (2) education for work--as a responsibility of the public schools--has been accepted in theory but not in practice; (3) programs and practices must catch up with stated policies (the public is demanding the development of special talents in children); (4) vocational education must and is being perceived more broadly to meet the public demand; and (5) diversity in educational programs is an absolute essential--a shift in emphasis is needed.

Education for work involves: cognitive learning, affective learning, and motor or manipulative learning.

Preparation for work must provide general education experiences. Each complements the other, since making a life and making a living are intertwined. The schools must help youth make the transition from school to work.

Education for work is a continuing process with the following outcomes:

1. Children will acquire a knowledge of the materials of our culture and develop a knowledge of how to use them.

2. Children will develop an understanding of the world of work and how they relate to it.

3. Children will acquire an understanding of the meaning of work in their lives and appreciate this understanding.

4. Children will develop a respect for the dignity of work and appreciate the value of work to a society.

5. Children will experience and appreciate good workmanship.

6. Children will develop good habits of work.

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7. Children will discover and develop special aptitudes and talents and relate them to productive activity.

8. Children will develop tentative career plans based on strengths and weaknesses and an understanding of the world of work.

9. Children will acquire specialized training for entry into the world of work prior to terminating their formal education programs.

10. Children will develop their capacity for continued learning in order to maintain their efficiency as workers.

11. Ultimately, adults would avail themselves of opportunities for additional training in order to maintain employment stability.

These concepts are of little value until translated into programs based on good teachers, excellent facilities, financial support, and quality leadership.

School systems must give attention to the following: (1) general education; (2) vocational guidance and career planning; (3) specialized vocational and technical programs; (4) placement services for employment bound youth; and (5) continuing programs of general and special education.

In order to give attention to these areas, the following principles of operation are listed:

1. Instruction must be given in the current fields of demand.

2. Programs must be planned in relation to local demands for youth and employers.

3. Larger units of school administration must be utilized.

4. Qualified persons must be employed to give leadership in the development of specialized vocational-technical education programs.

5. Teachers must be employed who themselves are competent in the field in which they will teach.

6. Faculty members of all subject matter areas and specialized vocational education programs must be involved in the development of the entire instructional program.

7. Adequate buildings, facilities, and equipment must be provided.

In the end, education should be determined not on cost alone but on what is best for the people. If the public schools will not meet the future, societal needs, another agency will.

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PART III

DESCRIPTION OF THE TECHNICAL EDUCATION STUDENT

A STUDY ON THE FACTORS OF JOB SATISFACTION AND ON THE LEVELS OF JOB-RELATED ATTITUDES AMONG DISADVANTAGED WORKERS

by

Joseph E. Champagne*

A comprehensive project was initiated in March 1965 by the South Carolina Committee for Technical Education, to determine on a preliminary basis the relative importance of job-related motivational forces among disadvantaged workers. A secondary area of investigation involved a determination of the differences in job-related attitudes among various subgroups of this population of disadvantaged workers. The need for such a study has long been evidenced by the rapid utilization of such workers in productive positions within our economic environment as a result of the many state and federally supported programs of vocational training and retraining of underprivileged, disadvantaged workers. Such a study was severely needed in South Carolina whose illiterate population is large, whose economic growth is extremely pronounced, and whose vocational programs are actively operating. It was felt that unless such information were collected and made available, some of the efforts of these programs would be lost or diminished.

In order to obtain the desired information, trainees of the federally supported Special Training for Economic Progress (STEP) were used. This is a massive vocational training program which has trained over 7,000 persons in South Carolina during the past two years. The trainees are generally underprivileged citizens who receive up to thirty-four weeks of vocational training.

Two instruments designed to assess the relative strengths of factors of job satisfaction and to measure the levels of attitude were constructed following rigorous psychometric procedures. The instruments were bound in a booklet which was prefaced by a detailed personal history questionnaire. This personal history information gave the data necessary to study different groups within the sample, for example, male versus female, young versus old, etc.

Data were collected on nearly 700 STEP trainees during the month of June 1965, using the motivation-attitude booklet. The results were then carefully analyzed, not only for the sample as a whole, but also for 63 subgroups based on sex, age, race, length of time in training, geographic area of residence, and various combinations of these five factors. In addition, the attitude data were analyzed on 3 additional groups, based on the employment history prior to STEP training.

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In general, it was determined by this study that underprivileged workers do have a pronounced need hierarchy within their motivational scheme. This hierarchy varies across race, sex, and economic environment of the place of residence, but does not vary much with age and even less with increased exposure to job training programs. Of particular importance is the fact that this pool of citizens regard their responsibility to a job as most important. The standard reward of pay is of relatively low importance but is more important than the fear of job severance or the fear of reprimand which are of extremely low importance. These facts point out the need for an employee-oriented supervisory pattern which rewards good behavior by praise and recognition as well as by financial rewards. These citizens have long been deprived of any form of recognition, acknowledgment, and acceptance, and these factors loom important in their need structure. These findings not only have obvious implications for the industrial market which is employing these trainees, but also to those structuring curricula and counseling programs for future job training programs.

What does the material developed by the study mean, and how might the findings be put to use? First of all, there are certain conclusions that are warranted rather strongly. The underprivileged worker has a high need to prove to himself and to others, especially those of the referent group, those to whom he aspires, and those who have social and economic control over his well-being, that he is an asset to society and not a mere liability. He has to prove that he can carry his own weight and that he is a responsible person--that is, that he knows his duties and has an inner need to live up to these duties and responsibilities. While he is aware of his role, he also demands in return, rather strongly, recognition for his potentialities, at least the opportunity to prove them. The data show without much question that these intrinsic rewards are far more important than the standard reward of pay. While there is no doubt that pay is important, it is certainly less important than intrinsic rewards.

It becomes obvious that an over emphasis on salary, to the detriment of other job rewards, is not consistent with the findings of this study. Of course, much research on other workers not classed as underprivileged has demonstrated that pay is by far not the most important motivating force on a job. It can well be an incentive to seek and retain a job, but it is not generally considered as an on-the-job motivational force as great as other intrinsic and psychological forces. The study clearly points out the importance of departing, once and for all, from the early theory of the purely "economic man" concept. Man, in this case the underprivileged man, is motivated not by a fear inducing boss, but rather by a considerate yet directive superior. Most leadership studies today are so vividly bringing out this fact, and to repeat them here would serve no purpose. But the point is that the data from this study has demonstrated the validity of extending these modern theories even to those workers who are being trained for purely the entry, blue collar occupational level.

It seems very evident that a basic guidance and counseling program in job training efforts is a necessity in order that the long under-privileged trainee may be more forcefully brought to the realization that he is being given a chance for improvement and that he will be expected to fulfill new roles. He will be expected to behave differently as he accepts the challenge of economic progress and evolution.

THE STUDENT IN PROGRAMS OF TECHNICAL EDUCATION

by

John Henderson*

The student in technical education programs is not easily defined; and perhaps there is no real need for a definition, since technical education is providing him with occupational proficiency, development of self-reliance, and a sense of responsibility toward community and civic needs.

The developing technological economy depends less and less on jobs that require limited amounts of education and skill, which previously served as a beginning point for young workers entering the world of work.

Today, the personal satisfaction of economic needs requires adequate skill and education to gain initial placement in a job offering steady and continuous employment. Today's average youth will shift occupations at least five times in a lifetime; therefore, a continuing education program is necessary to allow the worker to keep pace with technological advancements.

The following have a bearing upon the students in technical programs: personal experiences; easy access to community colleges which makes it possible for students to try even without home support; the influence of friends not in college; conflicts of interests with part-time work; purely academic, collegiate experiences; a less than competitive spirit; the role of the parents; and less opportunity for "joint effort" study in dormitories, fraternities, and sororities.

Young persons, the mature, out-of-school, employed or unemployed, the craftsmen, skilled tradesmen, highly-skilled technicians, engineering technicians, and professionals can profit from technical education. Technical education may be sought to improve.....the employment picture or to maintain minimum effectiveness in the worker's present capacity.

> A system of education that is open ended, with freedom for mature students to enter, leave when fruitful experiences seem more fruitful, and then re-enter, can be a reality through coordinated efforts of public schools, community colleges, vocational schools, universities and employers

is recommended in the report, <u>Technology and the American Economy</u>.

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Technical education with orientation for and preparation for post-secondary programs can be offered successfully in the high school to allow students to reduce or eliminate courses in collegiate or technical programs. A repercussion would develop only when a fraction of the high school students were afforded this opportunity for preparatory technical work. However, intensive technical programs during the high school years is narrow preparation.

In selecting students for technical programs, one should review the applicant's grades, rank in class, college entrance examinations, and interview the applicant relative to his interests and potential ability.

Students for the technical programs will be high school graduates from general or pre-technical programs, college drop-outs, returning servicemen, women, high school drop-outs, and persons with a middle or lower class social background.

THE STUDENT IN PROGRAMS OF TECHNICAL EDUCATION
by
William W. Purkey*

White rats and college sophomores have been the subjects of an amazing amount of psychological research; yet we know only a little about rats and even less about the post-high school student. Perhaps the reason for this situation lies in the preference of psychology for an exploration of organic drives and for an emphasis on an atomistic approach toward understanding people. In order to gain a more holistic and humanistic grasp of the student, this paper will present a more subjective, internal viewpoint and try to see the student as he might see himself.

In spite of the fact that today's student is more affluent than ever before (better educated, better clothed, more comfortably housed, healthier, etc.), chances are that he sees his life as more impersonal, more competitive, and probably more threatening. Often he is separated from both fellow students and teachers. Many times he is merely a statistic, a grade-point average, a student number, an address on an IBM card. He even gets letters from machines, which one day may begin, "Greetings: You are hereby ordered for induction into the Armed Forces of the United States." Coupled with this generally threatening situation is the student's low self-esteem which was developed during his public school career.

By the time high school is over, many students who graduate (as well as most of those who do not), are firmly convinced that they are generally poor bets as far as further schooling is concerned. The reason for this belief is not that the student is incapable or stupid but is that many teachers have built this negative self-concept into the student by giving him a lot of rich experience in failure. A major challenge of the technical school is to reverse this negative self-picture that so many students have.

It is fortunate that self-attitudes do not change readily, for if they did we would not have personalities. Yet marked changes in critical thinking ability, stereotyped attitudes about self and others, and dogmatism can be made during the post-adolescent period, particularly and primarily during the first two years after high school--the years when technical education is likely to play a big part.

What, then, can be done to improve self-attitudes? This paper would like to suggest three ways: (1) give students honest success experiences in worthwhile activities (success breeds success and failure breeds failure); (2) give students the feeling that they are of worth and value

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(personal interest <u>in</u> and respect <u>for</u> the student); and (3) encourage a feeling of commitment of students <u>and</u> faculty to each other and their subject (students are changed only by those things which have personal meaning and importance to them). Together, these approaches should produce graduates of technical education who are both competent technicians and successful human beings.

PART IV

ADMINISTRATIVE STRUCTURE OF TECHNICAL EDUCATION INSTITUTIONS

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THE ADMINISTRATOR'S ROLE IN PROVIDING SUPPORT FOR EFFECTIVE FACULTY-STUDENT DIALOGUE

by
David C. Epperson*

The administrator's responsibilities for providing space, personnel, and instructional resources are well recognized by those conducting the affairs of post-high school vocational and technical education. However, their responsibilities as stimulators of educational innovation, designed to cope with the emerging realities of our rapidly changing world of work, are not so clearly understood. Administrators are often unprepared for their role as shapers of a supportive educational environment. With the accelerated expansion being experienced in the community college movement, it is easy to get caught up by the pressures of building, financing, and public relations to such an extent that there is little time left for facilitating the establishment of an effective climate for learning.

It is my intention in this paper to focus on the administrator's responsibility for providing an educational environment that makes it possible for students to learn to adapt themselves to fluctuating occupational circumstances.

The current articulated purpose of post-high school vocational and technical education, as I understand it, is not simply to transmit information or to develop specific skills, but rather to help students develop a readiness to make adaptations to a rapidly changing industrial scene. Learning how to learn means learning how to become more flexible, and learning to be more flexible is indeed a complex task. It often requires modifications in the student's basic style of approaching the world.

If we assume the responsibility for developing this flexible learner, we are taking on quite a different responsibility than our predecessors who were preparing individuals for more static careers. By assuming the task of developing the capacity for what John Gardner calls, "self-renewal," we have increased the complexity of our mission significantly. We are no longer concerned with the development of specialized skills, for now we must focus on helping students acquire an all-pervasive style of approaching work.

How can those of us concerned with post-high school vocational and technical education assist the student in his efforts to prepare for a career of continual change?

First of all, we need to help him learn to think of himself as a flexible person.

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Second, we need to help him develop enough self-confidence to be able to take risks. The flexible person is the "risk-taker."

Third, we need to stimulate, or more appropriately, emancipate his "curiosity motive." Our educational system tends to do serious damage to native curiosity.

Our major responsibility, then, is to generate a supportive interpersonal environment where the student can learn to be flexible, where he can gain self-confidence, and where his natural curiosities can be freed. What are the dimensions of such an environment?

Let me suggest that an appropriate interpersonal environment for developing adaptability on the part of students can best be created where: (1) effective two-way communication between teacher and student is established; (2) status differences between the teacher and student ar reduced; and (3) the relationship tends to be emotionally close.

When Tyler (1964) asked a group of educators to specify the characteristics of an ideal teacher-student relationship, three similar dimensions were identified. It is interesting to note that these same three dimensions were specified when a group of psychotherapists of quite different theoretical persuasions were asked to characterize the ideal therapeutic relationship (Fredler, 1950). This may suggest that any interpersonal relationship that is meant to be the source of significant growth and development involves two-way communication in a peer type relationship which tends to be emotionally close.

The characteristic of adaptability is a dimension of personality, not simply a composite of information or a specific skill. To effect a significant change in personality is a much more difficult task than transmitting information or teaching specific skills. Hence, it is no wonder that vocational and technical preparation for our rapidly changing world deamnds new methods of instruction that provide education in depth. In the same way that a therapist has personality change as his goal, the teacher of vocational and technical education has the responsibility of assisting the student to develop adaptability, which often requires significant modification in the student's basic style of approaching the world (his personality).

Let us look at each of the components of the definition of an effective teacher-student relationship, as I have characterized it, so that we can see more clearly the nature of the problems of building an educational climate where students can learn how to learn.

In discussing effective communication, the first component of an effective relationship, I would like to include four major elements. Communication that is truly two-way demands some degree of mutual acquaintance. The teacher and the student need to know something about one another. Secondly, to learn to know one another demands mutual accessibility. Accessibility, then, becomes a prerequisite to effective communication. Thirdly,

the teacher must be willing to help students with a wide range of problems. Communication cannot be restricted to the specifics of a course. The goal of adaptability can only be achieved if the teacher deals with many dimensions of the student's personality. Finally, effective communication also demands agreement on the "rules of the game." Teachers and students need to reach consensus as to what to expect from one another.

The second component of an ideal relationship, peership, is reflected in dialogue where status differences are not evident. Teachers do not expect students to defer to them, and students do not feel the need to be ingratiating. Furthermore, democratic procedures are followed--students are involved in the processes of decision-making. A cooperative rather than a competitive climate is found, for competition with its attendant evaluation creates status differences between faculty and students. Also, mutual respect, trust, and honesty are evident.

The third component of an ideal relationship, emotional closeness, is reflected when both participants in the dialogue share with one another their personal concerns. Neither the teacher nor the student feels the need to be guarded or defensive. A teacher who provides an emotionally close relationship is one who attends to the individual needs of students. Mass treatment cannot be intimate treatment; hence, there must be an expression of interest in each and every student in the ideal relationship.

I have delineated above what I consider to be important dimensions of effective faculty-student relations if preparation for adaptability is to be achieved. It is my thesis that an administrative strategy that supports these types of faculty-student relations facilitates the process of learning how to learn. Specifically, I will outline some steps that administrators can take to generate a more effective climate for the development of flexibility in students so that they can adapt to the demands of our contemporary industrial world.

First of all, let's attend to what can be done administratively to facilitate lively and meaningful exchange between teacher and student. Unfortunately, there are few generalizations based upon research that can be drawn upon by the administrator. At Illinois, we are engaged in a series of studies to try to discover what can be done administratively. Our work is currently at a very primitive stage of development, but we have identified some factors which very well may contribute to the growth of different climates of learning. At this point, most of the factors identified have only an hypothesized relationship to the quality of faculty-student relations.

In presenting these factors, I will not attempt a thorough analysis of each. My intention is simply to offer to those involved in administering post-high school vocational and technical programs, a number of possible points of leverage if they wish to move toward improving the climate for "learning how to learn" on their campuses.

In looking at the first component of an ideal teacher-student relationship, that is, establishing communication <u>with</u> the student, may I suggest the following factors, all of which can be influenced to some degree by the administrator. The first group of factors is thought to influence, especially, the accessibility of faculty to students, and students to faculty.

Organizational size has often been thought of as a variable which influences the accessibility of faculty to students. There is not, however, substantial evidence to support the relationship between size and accessibility. In a recent study of Illinois junior colleges, it was found that the number of full-time students was related to faculty-student rapport (Wellner, 1966). However, it seems appropriate that this finding should be approached cautiously, since other factors regarding the way in which the campuses were organized were not controlled. It has often been thought that the size of the curriculum unit, that is the number of students enrolled in any one curriculum, would be related to the quality of student-faculty interaction. However, findings of Vreeland and Bidwell (1966) in a study of an eastern institution, and our study at Illinois of a midwestern university (Epperson, 1966) seem to indicate that the number of students enrolled in a curriculum has little relationship to the quality of faculty-student interaction. It seems logical, however, that the faculty-student ratio would have some impact on faculty-student interaction. Administrators need to concern themselves with size in planning for their institutions.

A second factor which needs to be considered is plant planning. It seems important to give recognition in designing buildings to such variables as accessibility of faculty offices to students. A report by a journalist on the progress of an institution that recently moved from an old site to a new site seems relevant here: "Students complained that at the (new campus) they did not have the informal contact that they had at the (old campus) where all faculty offices were off one corridor and it was easy to drop by for a chat.....at the new campus where all faculty offices are in a separate twenty-eight story building, faculty members are physically removed from students (Dunbar, 1966).

In addition to office accessibility, the eating arrangements made for faculty and students seem relevant. At an institution where I served on the faculty, a major eating place for both faculty and students was the Student Union. A separate room in the Union had been set aside for faculty use only. One day upon hearing students complain about the unwillingness of faculty to eat with the students, I asked them who had established the eating arrangements in the Union. The students believed that the faculty had arranged for this separate room. The conversation that I subsequently had with faculty members indicated that they were of the belief that the students had arranged to have a separate room for faculty, since it was the faculty's conviction that students wouldn't appreciate having them invade their privacy. It was necessary to conclude from the information that I gathered that the faculty and students were unaware of the sentiments of one another and that the eating arrangements which had established an <u>apartheid</u> system were separating students and faculty on

the basis of "pluralistic ignorance." It seems obvious that administrators have the responsibility for setting up opportunities for students and faculty to get together on an informal basis. When one plans a campus, this factor needs to be considered. It is possible to design a campus that will make it easy for students and faculty to have some form of informal contact. On the other hand, when one visits some campuses, it appears that every effort has been made to insulate the faculty culture from the student culture.

There are numerous organizational procedures which have the potential of influencing the quality of student-faculty dialogue. For example, the type of advising system that is found on campuses can influence contact between faculty and students. Some institutions hire professional advisors, a procedure which, while relieving faculty of one chore, also serves to separate faculty and students, one from the other. Administrators can influence the type of advising program that an institution establishes.

Another organizational procedure that can have an impact upon faculty-student interaction is the scheduling of teaching loads. Administrators assume responsibility for establishing equitable assignments for faculty. For some reason, we in the academic world feel as though it is essential for students to spend at least fifteen hours each week in formal classes; and on many campuses, where vocational and technical subjects are taught, a teaching load of fifteen to twenty hours is not uncommon. There is little reason to believe that there is anything sacred about fifteen "contact hours." What would happen if students were asked to meet with faculty less often, but in a more intensive fashion? We have given this alternative little chance to be tested. Administrators are in a position to encourage innovations in teaching that would permit a reduction in the number of formal contact hours, freeing teachers and students alike for more informal contact that might be much more productive than additional lectures in developing adaptability on the part of students.

Faculty personnel policies are also within the sphere of influence of the administrator. In the recruitment, orientation, and rewarding of staff, the administrator can have an impact on the accessibility of faculty to students. Establishment of rules and guidelines is not what I have in mind. The use of the administrator's position to stimulate and shape the standards and expectations of faculty is within his power. For example, the administrator can encourage faculty to be in their offices on a regular basis so that students can drop in for conversation. He can also discourage faculty from being absent from campus for long periods of time.

Since there is a tendency in the vocational and technical areas to depend upon part-time faculty members, there is always the problem of putting these faculty into contact with students. In institutions with high part-time to full-time faculty ratios, one might expect to find a lower level of rapport between faculty and students. While Wellner's study (1966) indicated a trend in this direction, the relationship was not statistically significant. It stands to reason, however, that if faculty are on campus for only a limited period, it is going to serve as a barrier to effective

informal contacts between faculty and students.

Student personnel policies can also have an influence on the quality of faculty-student dialogue. In schools focusing on vocational and technical education, there is usually a high proportion of students who are employed on at least a part-time basis. Their schedules of work put time at a real premium. Many students are on campus only when a formal class is in session. There would seem to be real advantages to working toward improving the full-time to part-time student ratio since Wellner (1966) finds a significant relationship between this ratio and faculty acquaintance with students. In view of the fact that work is an economic necessity for many and essential as training for others, it is important for the institution to take this bit of reality into consideration in their administrative arrangements. There are steps that can be taken to deal with the special needs of students who need to work. For example, the administration can aggressively seek scholarships and loans for students in need so that they can be more available for informal contacts with their teachers.

Additional student personnel procedures, such as orientation sessions, informal retreats, and student-faculty activities can contribute to the type of faculty-student relations that facilitate the development of adaptability in students.

Let us now turn our attention to an examination of some factors which may affect the status system. Since emphasis upon status differences has the potential of doing damage to faculty-student dialogue, it would seem appropriate that the administrator take steps to reduce status barriers. The place where status differences are most often revealed is in decision-making. It has been traditional in our educational system for faculty and administrators to decide upon what is appropriate for students and then to transmit and enforce these decisions. It has been in only rather irrelevant areas that faculty have invited students to participate in decision-making (e.g., when and where a dance will be held). In the past few years, students have been calling for a greater voice in campus decisions--decisions which have a bearing on curriculum and instruction. If educators fail to recognize the students' rights to participate in significant decisions, they are, in effect, reaffirming the status system.

Status defining factors include campus arrangements that enforce faculty-student segregation, such as separate faculty dining rooms as was previously mentioned. When a student walks down a corridor and sees "faculty only" printed on restroom doors, it is a clear-cut reminder of his status. These indications of segregation in post-high school vocational and technical education may very well reflect the historical linkage between secondary education and post-high school programs in vocational and technical areas. It seems imperative for the administration to make an effort to reduce the effects of this tradition if status barriers are to be overcome.

Status differences are also evident in certain types of faculty involvement in student discipline. If the administration has permitted

faculty to assume responsibility for student discipline, the effects of a punitive role may be reflected in status differences. If, on the other hand, faculty, students, and administrators, as representatives of the institutional community, jointly participate in the enforcement of order-keeping policies, the differences in status among the participants will be less evident.

The ceremonial traditions of an institution have the potential of being either unifying or status defining. Traditional academic ceremonies with clearly defined status distinctions, which evidentially are intended as rites of passage, do little to generate peer-type relations. I do not mean to imply that ceremonial traditions necessarily are a divisive element in the educational community. It is possible to conceive of ceremonies which, in effect, reaffirm peership in the community of scholars. Ceremonies might be very effective in intensifying commitment to a common set of goals, purposes, and the means for achieving them.

Finally, I would like to suggest some factors which can influence the third component in the definition of an effective faculty-student relationship, that is, emotional closeness. All of the factors I listed up to this point are, of course, relevant to an emotionally close relationship. It is quite difficult to establish a close relationship when either the faculty or students are inaccessible to one another or when the faculty insists on maintaining status barriers between themselves and their students. Here are some of the factors that I see affecting the closeness of relations between faculty and students.

The factor which has the greatest effect on the closeness of the relationship is the type of evaluation system employed. When grades are emphasized, a dimension is added to the relationship that makes it difficult for the teacher and student to get close to one another. The student is always guarded for fear that he will reveal weaknesses. The teacher, on the other hand, feels the need to maintain distance, knowing that it may be necessary to make an evaluation of the student that does not meet the student's approval. The fact that our educational institutions are charged with the responsibility of certifying and selecting students for roles in society, as well as the responsibility for teaching, imposes a distance-defining dimension on the relationship. Recently the University of California at Berkeley adopted a "pass-fail" procedure for certain courses with the hope that it might de-emphasize the evaluative role of the teacher. Another evaluation model, rarely found, is the system of external examiners, where the student and teacher join in a cooperative effort to meet the standards of an external examiner. While this approach has the disadvantage of emphasizing preparation for an examination, it does generate a different climate of relationship between teacher and student, one that has the potential of permitting greater emotional closeness.

Another type of evaluation that can influence emotional closeness is student evaluation of faculty. Some institutions are moving to a

system of evaluation of teachers, the results of which are to be offered as evidence of the teacher's competence. Introducing this evaluation dimension into the relationship can also create distance between student and teacher.

It seems important at this point that a distinction be made between feedback and evaluation. Every emotionally close relationship has the component of frank communication between the participants. They let one another know if there is something in their relationship that is not to their satisfaction. This feedback is not, however, a formal institutionalized method of communication--rather it takes place naturally in the course of interaction.

It would seem that the administrator is in a position to affect the type of evaluation systems that grow in his institution. If he chooses to support one type over another, he is in effect influencing the degree of closeness in faculty-student relationships.

The administrator can affect the closeness of his relationships in other ways as well. If he establishes, through building plans and general policies, arrangements which encourage large lectures, he is making it more difficult for the teacher-student interaction to have a dimension of closeness. Building plans and administrative policies often encourage the establishment of large lectures. Administrators have great influence on building design and on general instructional policy, policy which in some respects prescribes educational method.

One aspect of building which influences the nature of emotional closeness is the privacy afforded by faculty offices. It is a great temptation for administrators to economize by crowding staff in offices. It is difficult for a student to be candid with a faculty member when he knows that he will be overheard. The administrator's insistence on planning for office privacy can add to the probability of emotionally close relations developing between faculty and students.

Another opportunity for the administrator to exercise his influence on faculty-student closeness is in providing the necessary resources for field experiences when appropriate. When faculty and students are able to go to the field together to work on common problems, the possibility that closeness will be generated in the relationship is enhanced. Both common experiences and an informal context for interacting are provided.

In view of the fact that administrators usually play a significant role in the selection of faculty, they are in a position to influence the type of individuals recruited. There are quite different orientations toward teaching among those applying for staff positions. From letters of recommendation and in interviews, the teacher's style of relating to students is often revealed. It is within the power of the administrator to encourage the selection of those candidates who seem to have the capacity for relating effectively with students. Too often teachers are hired strictly on the basis of their academic credentials. A systematic

recruitment effort is required if a supportive faculty-student climate is to be generated.

There are still other factors over which administrators have influence that ought to be considered as contributing to the quality of faculty-student relations. For example, the system of providing rewards and recognition for faculty is within the administrator's sector of influence. He must make every effort to see that faculty members who are effective in communicating with students, who do not feel the need to hide behind their ascribed status, and who have the capacity for entering into an emotionally close relationship are appropriately rewarded. If he fails in his efforts to see that these individuals are recognized, it will be most difficult to build an effective faculty-student climate.

In addition to having influence over policies affecting rewards, the administrator can take steps to provide a program of in-service training that will give attention to the campus interpersonal climate. In-service sessions can be planned with both faculty and students working together toward the goal of improving the climate for learning. In-service training programs often get low priority in educational institutions because they are activities that can be postponed without apparent immediate consequences. It is the administrator's responsibility to keep long-term consequences always before him, for if he fails to search continuously for ways of improving the climate of interpersonal relations on his campus, he will be neglecting one of the most important aspects of his role.

I am persuaded that there are many actions that can be taken by administrators to enhance the quality of faculty-student interaction and hence improve the possibilities for developing the ability of students to make appropriate adaptations to our rapidly changing industrial world. It is my hope that those who are being called upon to plan and develop post-high school vocational and technical education will be able to keep the faculty-student interaction process central in their thinking as they make decisions affecting their educational programs. As can be seen, some of these factors I have mentioned can be influenced directly by the administrator, such as the accessibility of faculty offices. Other factors can be influenced only indirectly by such means as appropriate staff recruitment and training. Sometimes the administrator may feel that he is lacking in the power to influence the quality of faculty-student interaction. In addition, limited resources may restrict his ability to take action when a need is identified. If, however, when priorities are being set, major consideration is given to enhancing teacher-student interaction, the administrator will have taken a significant step toward establishing a viable climate for learning.

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THE ADMINISTRATIVE STRUCTURE
OF TECHNICAL EDUCATION
INSTITUTES
by
John Henderson*

Recommendations contained in the report, Technology and the American Economy, concluded that: (1) free public education should be provided to all Americans through the fourteenth year, either in junior colleges, community colleges, or appropriate post-secondary vocational institutions; (2) most vocational and occupational training should be given at the post-secondary level; and (3) the opportunity for college education should not be denied to any qualified American and should be made available through an appropriate system of loans and grants.

Specific legislation has not as yet been introduced in the states to accomplish this task.

Statewide patterns for technical education--it is observed--are under study and undoubtedly will be revised.

In New York, the State University is:

> committed to comprehensiveness in (the) two-year colleges: horizontally, in the provision of university parallel, lower-division offerings side-by-side with an array of technician-level career offerings, but also vertically in the occupational or career type of offering. We no longer confine our occupational offerings to those of the two-year technician level but .....offer programs of any duration short of two years and in practically any fields of skill demanded by persons of post-high school age to remediate their unemployment or under-employment.

There is a natural tendency for the two-year programs to follow an upward trend and arrive at a point where the breadth and depth of technical programs are quite sophisticated and beyond the ability of many potential students. Industry has come to recognize the value of graduates of this level of program and.....provide for utilization of these graduates.

Criticism of this development lies in the fact that technical positions.....cover a wide spectrum of job classifications. Most manpower analysis reports present long-range shortages.....not all require the high-level technician programs. There is a need for greater emphasis on intermediate level technician programs.

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Recent federal legislation.....is causing many new developments. In New York, the Vocational Education Act of 1963 has provided "seed money" that will allow the development of area vocational schools which will serve, primarily, the secondary education programs. Some vocational-technical adult courses will be offered; but the primary responsibility for post-secondary education is being left to the community college.

The nature of the area school is such that it provides cooperative education services on a one-half day basis five days a week, updating of vocational-technical programs, orientation for continuation in a technical program at community colleges, and needed articulation and positive outcomes.

The educational and training programs.....as provided (for) by the Manpower Development and Training Act (MDTA) and.....the Economic Opportunity Act influence administrative patterns. In New York State, they are outside the two-year colleges with the MDTA programs in the recently developed skill centers in urban areas. These devote full attention to meeting manpower needs.

Several organizational patterns for technical education are emerging in the various states. Nearly all provide technical education on a single campus. Programs of all types, in all fields, are available to meet the identified needs of the community the college serves.

Maurice Graney, author of The Technical Institute, submits that two types of technical programs exist. In one, the technician is given training with an occupational objective while the other is educated to work in a supporting role. In the latter, emphasis is on an academic approach.

Leadership for the development of post-high school technical programs has been provided by the technical institute offering curricula closely related to engineering. The proprietary institutes have tended to be single-purpose, post-high school colleges offering two-year programs with less emphasis on "general education."

Accreditation by the Engineers' Council for Professional Development (ECPD) has been one standard of excellence applicable to technical institute-type colleges. The public and non-profit technical institutes normally follow academic administration patterns. Proprietary schools resemble less the typical academic hierarchy with the owner-president deeply involved in all operational phases.

Highly reputable technical institutes will continue, but future technical programs will be developed almost exclusively in community colleges.

Some technical institute divisions continue to exist within university systems. The administration.....is typically through a technical institute director upwards to an academic dean or vice-president.

Area schools or single-purpose schools are normally administered by secondary schools and offer vocational and technical programs for in-school youth, the unemployed and underemployed, and workers seeking to improve their skills.

Considerable effort is being made by all branches of the Armed Forces to develop technical schools to train supporting technical staff to operate today's complex military equipment. Many colleges.....allow academic credit to servicemen returning to college.

Increased development of comprehensive community colleges will limit enrollments in apprenticeship programs, business schools, on-the-job training programs, and industrial and correspondence schools involved in single objective technical education.

Another recommendation contained in Technology and the American Economy was the establishment of a nationwide system of education through two years beyond high school. If established, this would require introductory courses in technical occupations; transfer, career, and specialized programs; and increased counseling, testing, referral, and placement.

In all of the recent developments in technical and career-oriented education, no fixed organizational pattern has evolved in the states.

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LOCAL POWER STRUCTURES AND EDUCATIONAL PROGRAMS

by

Ralph B. Kimbrough*

Community power structure is being discussed at various levels of education and in a number of other activities. It is possible for many misconceptions to result from these discussions. We mean by community power structure the distribution of power among individuals in the community. For example, if you are interested in a program for the city of Gainesville and in influencing political conditions in favor of that program, you are concerned with locating the people and groups that hold power, and to what extent, in the city.

Little had been done to study the phenomenon of power in a community until Hunter published the results of his study of Atlanta in 1953. Hunter and we are interested in the process of decision-making, and it is assumed that if we can find out something about the process, we can influence its operation.

Starting with some smaller studies, Hunter in 1950, made a calculated study of the people who hold power in Atlanta and how they use this power to influence decisions. He shocked the academic world when he said that power in Atlanta was held by a very small monolithic group. The number of people who made the important decisions could be counted on your two hands. If the structure were sketched, it would take the form of a pyramid.

Hunter said the decision-makers were the owners of financial, commercial, and industrial corporations within or near the city. The next level of leaders set the strategy for the decisions which were initiated. This second level hierarchy was made up of bank vice-presidents, ranking public officials, public relations men, small business owners, and a few professionals. Following the second hierarchy were leaders who functioned to hold the line of policy as it was made and put into effect the strategies of the top decision-making group. Hunter found civic organization personnel, newspaper columnists, petty public officials, social workers, teachers, ministers, and small business men in the third and fourth hierarchies.

About the same time that Hunter was studying Atlanta, we were studying a small school district near Nashville, Tennessee. The population of the community was about 10,0[illegible], and we did a thorough analysis of the power system. We found quite a different structure from what Hunter found in Atlanta. We found a competitive structure where there was basic competition between two power groups with frequent participation by state power wielders. Also involved were little satellite groups which could

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get into decision-making at certain times. The basic fight was between young men who wanted to change the community and the "old gang" which wanted to maintain the community as a nice quiet residential area. So we had a regime conflict over the issue, "What kind of town should ours be?" The conflict was between elite groups with little participation by the citizens.

What we have been talking about in both situations is not a formal structure. A formal structure is the University, the Rotary Club, or the Chamber of Commerce. The types of cliques that are formed within the formal organization are known as the informal organization. They are little power factions that get started within a formal organization and try to run it or influence it in terms of their interests. The informal organization has a structure, norms, a type of communications network, and a leadership structure just as surely as a formal organization; but it does not have by-laws, elected or appointed officers, or formal meetings; it has only the name of the people associated with it such as "the old gang" or the "new bunch." Remember, power can be exercised both formally and informally.

In Hunter's situation, it was largely an informal exercise of power. Decisions were made privately and promoted publicly. Some of the decisions in our Tennessee school district were fought out long before they ever got to county officials to be voted on.

Professor R. L. Johns and I are studying intensively twenty-four school districts in four states. We are attempting to see whether we can show a relationship between community power structures and financial effort to support education. I need not remind you that if you are going to make changes in technical education, money is involved. All too often we forget that to make innovations, money is necessary. Any time your program costs money, you are going to come into contact with a community power structure which may have definite opinions about how much money should be spent. You are going to be forced to deal with the political systems of a community or a state.

I can best illustrate the relationship between community power and educational finance by reporting on another study which involved two school districts in Florida. One of the districts studied had the highest level of financial effort in the state while the other had the lowest level of effort. By financial effort, I mean that contribution made to support education with relation to the ability of the community.

The low-effort district was one of the tightest little monopolies that I ever witnessed. It was controlled by a small group which had at the top a couple of bankers, some business men, a few public officials, and businessmen-legislators. Control was extremely tight. Top men in the structure even headed committees that decided whether they were going to raise teacher salaries or not. This committee made its report to the Board of Education which had appointed the committee. The school superintendent was never mentioned by anyone in prominence as having any

leadership. I feel that he was almost powerless. There was great fear and suspicion among teachers in the district with regard to the use of instructional materials. They were very loath to use materials in social studies which might be considered as controversial. There was an extremist group in the community which continuously harassed the school. This was one of those extremist patriotic groups who played right into the hands of the conservative people who were controlling the power structure. If such extremist groups can keep us educators fearful, then we won't have to participate in any decisions. In this district, we could get only fifteen names of influential persons, and only five could be identified as decision-makers.

In the high-effort district, more influential persons were named. There were forty-three persons named as very influential in the structure. The superintendent of schools was one of the nine most influential men in the county. It was said of him that, "He runs a dynasty." There was a pluralism of five or six influential groups which were participating effectively in decision-making in this community. No one of these groups could control decisions.

From these examples, we can begin to see power as being on a continuum. At one end of the continuum are the little closed societies and at the other end the open societies. In the open societies, it is much easier for a person to gain access to leadership in the system than it is in the closed societies. In the high-effort district, one very influential leader had resided there only four years; yet he had risen to the top leadership position. A large number of leaders in this same district had resided there only a few years. By contrast, in the low-effort district, most of the leaders were over fifty years of age and had lived in the community practically all their lives.

It behooves us as educators to understand the operation of power systems, to identify the leaders who control the system, and make maximum use of power to aid the cause of education. This calls for active involvement of educators in the decision-making process. For too long, too many educators have looked upon politics as something in which they could not afford to become involved. As a result, educational programs have suffered. We can no longer afford to remain naively inactive in the application of power to bring about favorable action on educational issues.

THE ADMINISTRATIVE STRUCTURE FOR TECHNICAL EDUCATION

by

Harold Matthews*

Vocational-technical education requires an administrative vehicle to make it go. A good administrative structure can make a mediocre educational program effective, while poor administration can render the best educational program ineffective. Administration involves people and things. These two elements must be provided a common purpose and organized so that each contributes to the maximum effective accomplishment of the purpose.

Organizational structure is necessary in order that there may be a division of labor and effective cooperation between the several segments. Each person in the organization should know who is responsible for particular functions and who reports to whom. Organization is only a means to an end and not an end in itself.

The administrative process involves the following functions:

Planning--deciding what is to be done.
Organizing--providing ways and means for accomplishing purposes.
Directing--seeing that the job is done.
Coordinating--seeing that all elements work together.
Controlling--use of legal authority for financial control.

The organizational structure must provide for the effective performance of the functions just listed. Obviously, the chief administrator cannot effectively perform all these functions himself. Delegation of duties to others is necessary. This delegation and division of labor requires effective communications. Communications must be effective on a two-way basis if the task is to be clearly understood and effectively performed.

Technical education was first provided by private institutions called technical institutes. These technical institutes had the following characteristics:

a. Singleness of purpose.

b. Post-secondary status.

c. High tuition cost.

d. Part-time staff drawn from industry.

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e. High standards.

As the community college came upon the scene, technical programs were broadened and became available to more people. Tuition in the community college is low or nonexistent. Educational programs are more comprehensive and multi-purpose. The community college can effectively prepare technicians and at the same time, provide for updating the training of earlier graduates. In effect, the community college both fills in and fills out educational voids.

As programs of technical education become more extensive and more students enter the programs, greater attention must be given to administration. The comprehensive community college, with its multiplicity of programs, activities, and multiple campuses is seen as the locus for training most of our technicians. If we are to offer effective technical education in this milieu, the administrative structure must provide for:

a. A sufficient number of interested students.

b. Adequate physical facilities.

c. Qualified staff.

d. Adequate financing.

e. Administrative organization

THE STATE ROLE IN TECHNICAL EDUCATION
by
Carl W. Proehl*

I would like to share some thoughts with you on the tremendous challenge which lies before technical education today and will do so in terms of three major areas--The Challenge, The Patterns, and The Implications. Although my remarks are not directed specifically to the "state role" as such, I think that you will find the role of the state in technical education implicit in this presentation.

In speaking on the subject of leadership, I must decry, among other things, our lack of insight into the real demands for technological advance--a lack of insight conditioned, in large measure, by our own materialistic value system. The root of much of our trouble, it would appear, lies in our failure to have as much respect for developing men and ideas as for making and acquiring things.

Today, in addition to the "space race," there is another challenge to technical education. Education is beset by many problems; but our major educational problem is, in reality, a social crisis hidden by our 20th Century affluence and abundance--a crisis compounded by unemployment, racial tensions, juvenile delinquency, swelling public welfare roles, chronically depressed areas, and a growing inequity in educational opportunity. At the center of this crisis stands a system of education which, in too many ways and in too many places, is failing to prepare individuals for a new world of work in an advanced technological society. This is the challenge which the changing world of work hurls at education: there is an urgent individual and national need for the development of skills which is not being met adequately today!

Technology has indeed created a new relationship between man, his education, and his work, wherein education is placed squarely <u>between</u> man and his work. No level of American education has fully recognized the fact that technology today, in effect, dictates the role that education must play in preparing man for work. As though this were not enough, the nation's education system, when viewed as a whole in what has been described as a gross imbalance, is concentrating attention on the 20 percent of students who graduate from college. What about the other 80 percent who will not graduate from college?

Similarly, the full impact of the new technology itself has been slow to register on the American consciousness. To date, instances of technological unemployment are like the cap of an iceberg. Failure to understand what lies below leads us into believing that we can sail comfortably ahead without changing course. The forces of technology--

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automation, computers, laser beams, and space travel--are immediate and national in scope and carry serious consequences. Therein lies the challenge to technical education: We need to provide the kind of education which will help us deal with the impact of all the forces of technology on our society.

The patterns of technical education in Florida are based on the belief that the task of education is to adapt instruction to the abilities and capacities of students, to build on the environment in which they live, and to extend and enrich that environment. An effective program of technical education must be rooted in these beliefs and must be based on the future technical and vocational needs in rapidly growing Florida. Our educational program makes the following basic assumptions:

1. Occupational education is a necessary and integral part of the total education process.

2. An effective program of vocational-technical education requires that the program, at any level, be properly articulated with the educational program that immediately precedes or follows.

3. Vocational-technical education must be flexible so that it may continually be adapted to change.

4. Provision of equal opportunity for occupational education is conditioned by a number of factors related to population density.

To meet the requirements set forth in the basic philosophy of vocational-technical education as modified by the assumptions just mentioned, varying organizational patterns have been devised to meet the particular needs of local communities. The organizational pattern includes programs at the secondary level, including vocational high schools, technical high schools, and programs in comprehensive high schools; vocational and technical centers at and below high school level; technical institutes for technical training for high school graduates and below; area vocational-technical schools which cut across all levels; and technical training found in junior colleges.

There are four basic plans under which community junior colleges may organize and operate general adult and vocational-technical educational programs. These are:

1. The community junior college has primary responsibility for education of persons beyond high school age.

2. The community junior college has responsibility for associate degree and certificate programs, plus certain other offerings for adults, not provided in the general adult or vocational education program in the county school system.

3. The community junior college has responsibility only for associate degree and certificate program, plus certain short courses, institutes, etc., related to existing programs of the college and similar to college credit courses.

4. The community junior college has responsibility only for programs for which college credit is awarded.

The pattern varies, depending upon the local situation in which the junior college is found.

Finally, I would like to mention some implications for all of us in education. In the main, the problems facing us are those which only education can resolve. In resolving some of the major problems as created by technology, it appears that education has three major tasks:

1. Educators must acquaint themselves fully with the nature and dimensions of the problems created by automation.

2. Education must readjust its approach to vocational and technical education. There is little purpose in preparing people for jobs which will no longer exist. We must upgrade vocational and technical skills in order to eliminate the imbalance which exists between the unemployed-unskilled manpower and unfilled-skilled jobs.

3. Concern in education must shift more to the development of people as human beings and less as cogs in an economic machine. "Man has got to learn to live."

We must view technology, not as an end in itself, but as a means to an end, and that end being determined by man himself. Short of this, we must concede to Eric Fromm that while we have the technological know-how, we do not have the know-why nor the know-what-for. Such a concession could only lead us to the brink of disaster.

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PART V

PROGRAM PATTERNS AND CURRICULUM DEVELOPMENT
IN TECHNICAL EDUCATION

THE TECHNICIAN AND TECHNICAL INSTITUTE YESTERDAY, TODAY, AND TOMORROW

by

Harry Bigelow*

We are here today to examine the technician and the technical institute yesterday, today, and tomorrow.

Yesterday

The duties of the technical staff man and the technician are in a continual evolutionary process, particularly at the research and development level. New technology is being born somewhere every day in a research and development situation. Alert management is applying this and converting it to business and profit. Both the staff man and the technician are often quite primeval when they have entered upon something new--relatively crude or unrefined in their techniques as well as in their total knowledge of what they are doing. The degree to which they have the basic and technical knowledge to master their new field will greatly assist this evolution to a sophisticated level. Witness, for example, the evolution of nuclear energy as applied to reactor technology development since its beginnings twenty years ago in simple pile experiments to a highly sophisticated and booming reactor development program that is covering the very earth. The men who did the first experiments were working with basic principles on a very elementary experimental level. Subsequently, they developed elaborate instrumentation to control and measure the performance of their experiments. The unknown hazards were such that a whole experimental garden of reactors sprouted up over these twenty years in the southern Idaho lava bed desert. The technician level of skill was even more elementary--he was often nothing more than a high school graduate who had shown a mechanical interest, experience and aptitude, a strong back, and a willingness to follow directions. The technical know-how, as well as the applied technological aspects of the work, were largely handled by the staff. The role of the technician was simple by today's standards. It was, in fact, more the role of an assistant who required no specialized training as most of what he was expected to know or do could be taught him on the job.

The technician of twenty years ago could be compared to Rip Van Winkle awakening to a changed world were he to be brought onto the scene today. Without the intervening on-the-job experience, continuing education, or retraining, he would not be considered for employment today because of his inability to contribute sufficiently.

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**University of Illinois.

The utilization problems that the Laboratory has, whether staff or technician, are no different than what any other business, including your profession, has, namely, what to do with the personnel who arrived on the scene some twenty years ago when the requirements were different from what they are today, but who do not meet the changing requirements of their positions. We have some of these technicians, and it becomes increasingly difficult to search for work at their lower level. Also, some may not have the basic aptitudes or interests to learn the sophisticated and more theoretical technology of today as contrasted to the level of the work they were quite capable of dealing with at the time they were hired. Thus, we see that each new technology becomes more complex as it evolves. For the employees to progress with it, they must be capable of evolving with the technology.

The twenty years since the birth of reactor technology have made great changes in the post-high school training requirements this man is expected to bring to his job as a technician. In fact, this man we now call a technician because he has been introduced to many of the principles of the discipline he follows and has equipped himself with sufficient applied scientific and engineering information and skills, can adapt with short company training to any of the many new technologies. For these reasons, the Laboratory, starting about 1957 or 1958, began to place a technological floor, so to speak, under the newly hired, of at least a technical institute level of education or equivalent. This criterion gave assurance that the applicants had survived a two-year program in a technical specialty of mutual interest. This also pre-supposed that they had continuing interest in their own growth. Further, because we were engaged in research and development and were dealing with theoretical and experimental scientists and engineers, we sought the best men in the class that we could hire, rarely dipping below the upper quartile. More often than not, those hired were in the upper decile. There are, however, hazards in selecting people of this caliber if they become assigned to routine operational or service technician positions where the job challenge is insufficient to halt the onset of boredom.

There are technicians who are uniquely qualified for staff assistance in these positions through maximum technical understanding of the field and characteristics that make them amenable to an ever-changing scene--interested in factual results, per se, plus the personality to persist through frustrations in the search for these facts.

Where do they come from? The two-year technical institute graduate comes to Argonne National Laboratory from any of the technical institutes in the nation or from community colleges having such graduates as well as some liberal arts and science junior college graduates. We have drawn heavily on Wentworth, Broome, Oregon Tech, DeVry Tech, Southern Illinois University, and many others too numerous to list that have tended to meet our requirements. Our recruiting program, therefore, is national in scope. Also we find that every technical institute cannot and need not offer every technology, for there is a separate demand for each technology.

What sort of training do we expect this two-year graduate technician to have upon entry into the work situation? While he wouldn't be expected to have the broadest introduction to science and math, it would be important that he have some understanding of basic scientific knowledge in the engineering or scientific area where he was to act in a supporting role. This could involve biology, medicine, industrial hygiene or safety, physics, mathematics, computers, statistics, vacuum systems, instrumentation of all sorts, electronics and electricity, drafting, materials, metallurgy, machine shop techniques, report writing-measurements, data acquisition and processing, error probability, and scientific methodology. We would also expect him to be oriented as a professional support person rather than as pre-professional or as a professional. The problem of the B. S. graduate as a technician is his professional orientation as an undergraduate, contrasted to associate degree graduates whose school and employment orientation is one of following direction with trained technical competence.

The broader technological base that you provide him, plus current continuing education upgrading courses, is the technician's primary long-range job security against obsolescence. For example, the electronics technician who has not updated his electronics information and skill in the evolution from tubes to transistors, would be unemployable in a modern computer company laboratory.

To counteract this potential under-utilization of technicians and to maintain their capability for broad individual assignments in our divisions, we do not always permanently assign technicians to staff men for indefinite periods, but often pool them under a chief technician who has knowledge of the primary requirements of the individual experimenter. At times of peak demand, or in slack periods when staff may be on extended leave, or when experiments are terminating or changing in nature, the technician may be shifted to other assignments for temporary or indefinite periods. This preserves flexibility of the group and provides a pool of skills for the experimental or theoretical staff researcher according to his needs.

The staff man normally plans his experiments and interprets the results of measurements. He looks to the support personnel for assistance in procurement, design, assembly, testing, operation, and data or measurement acquisition. This support that he must have involves substantial technical information and capability for knowing specifications and suppliers; and it also involves his having technical capability to build and test the experiment including varying degrees of scientific knowledge in the physical and natural sciences, electronics instrumentation, design and drafting, machine shop techniques, materials, etc. Thus, the technician knows how to use and apply the tools of research but is not expected to develop new concepts from basic knowledge.

What has been the scope of our utilization of the technical institute graduate? There has been a regular growth in technical institute graduates hired at the Laboratory since about 1958. At last count, there were some 259 associate degree technicians on payroll. These have been

in such technologies as electronics, nuclear, metallurgy, instrumentation, design and drafting, engineering/physics, mechanical, aeronautical, electrical power, machine, and others. There have been occasional two-year liberal arts graduates hired for a technician position in chemistry or physics/math areas.

The progress of these technical institute graduates has been universal throughout the Laboratory. Some left the Laboratory to resume full-time education at regular colleges and have received partial or full accreditation for their technical institute education. The majority of the others, if my division is typical, have participated in some form of continuing education. All of them have been promoted at least once from the hiring level of Junior Technician and most, if not all of those hired back in 1958, are now Senior Technicians. Some have attained Scientific Assistant status where they were capable and had the opportunity to do work normally required of a B. S. or B. A. Within their own classification, they have done well in four major areas as Engineering and Scientific Technicians, Reactor Operators, Health Physics Technicians, and Computer Operators.

I am sure you are curious as to what these technicians actually do. Here are three capsulations of what your graduates are doing for us:

1. An example of typical duties of an engineering or scientific technician would read as follows:

   Is responsible for the manipulation of controls--remote to direct; for servicing a nuclear reactor or Van de Graaff accelerator or other Laboratory experimental equipment and instrumentation; for insertion and removal of radioactive samples; for acquisition of data and control of operations through reading of recording devices and computers. Assists staff members in setting up all types of experimental equipment and tests and maintains same. Assists in unloading and reloading and operation of nuclear reactors.

2. An example of typical duties of a Health Physics Technician are:

   Evaluates type and degree of radiation hazard from acquired data. Recommends shielding, worktime limits, protective clothing, respiratory equipment, protective devices, and personnel monitoring equipment. Renders assistance and advises on decontamination of areas, equipment and/or personnel. Recommends storage, transfer, and transportation on or off site of radioactive materials and contaminated equipment. Assists in emergency decontamination of personnel or areas and performs on-the-scene

analysis. Collects and analyzes air and gas samples. Gives instruction in the use of all types of detection instruments, protective clothing, and respiratory equipment.

3. An example of typical duties of a Computer Operator are:

   Wires control panels of peripheral equipment such as external memory, data communicating, synchronizing, input and output recording or display devices; selects and loads input and output units with materials such as tapes, punch cards or print-out cards for operating runs. Assists programmers in analyzing and debugging new programs. Operates electronic computer from console and auxiliary equipment.

Tomorrow

Having reviewed the technician yesterday and today, what about the future? You are the educational proprietors that have the vital challenge and responsibility of educating the technicians of the future. Your proprietorship has provided the basic ingredients to launch the technicians from the educational pad into the vast spaces of science. They have been prepared in your organization and are leaving their base of learning and theory, equipped with fundamental knowledge to apply in their chosen endeavors.

Their application of scientific, engineering, administrative, service knowledge will fission and fuse into a contribution and reward which will mark their progress in vocational growth and socio-economic achievement which are essential to career stability. Career stability is not only vital to them as individuals but to our nation's future, for we shall require vast numbers of technically qualified citizens to continue the explorations of unknowns, whether they be in the scientific, educational, sociological, humanities, engineering, or service fields. Technicians are one of the keys which, properly utilized, can add to the expanding framework of fundamental knowledge required for the continued preeminence of our nation in the evolution of the highly technical and specialized community.

There are dangers inherent in the present trends both to the individual and the society of the future. Two major areas are:

1. Personal development of the individual may be limited to a discipline with failure to recognize interrelationships.

2. The development of communications gaps between the various research disciplines is well known, but this is one facet of a broader problem. A stratification of society could well develop due to lack of understanding and appreciation of the contributions that each segment makes to the whole.

Moreover, it is questionable if we might not have a foreclosed society if we do not build on cooperation and use of interrelationships to demonstrate our differences rather than upon stratifications of them which will lead only to induced explosiveness. In these areas, it is essential that educational leadership create and develop programs to alleviate such hazards.

By providing a continuity of educational opportunity to amalgamate personal development with social understanding, your organizations will make a magnificent contribution to a future dynamic society. You are today in the unique position of undergirding technical development on a national basis; yet you retain a community leadership, significance, and understanding. The impersonalized remoteness of the great university even in the megalopolis does not directly challenge your community leadership or your community responsibilities.

In 1965, there was an increase of 50 percent in the younger age groups who are eligible to seek post-high school education, over the number in 1960. Population projections in the next decade show a continued growth in the eighteen-thirty year old segment of our population. In the same period, expansion of educational facilities at the technical institute and junior college levels has followed a similar pattern. Even though the number of births per thousand may have stabilized by the time today's children reach the age where they will require your facilities, future occupational requirements will be demanding that even greater numbers of our total population obtain post-high school technical competence. Hence, your responsibility is an ever-expanding one in curriculum quality and quantity. With the likelihood of changing or new technology every decade, you have thrust upon your shoulders the greatest challenge in educational history--the development of individuals to serve the community in which you are located. Your curriculum responsibilities include not only the development of trained technical intelligence but its integration with general education and retraining of obsolete or unemployable workers. With today's development of megalopolis, the survival of your community may well depend on how well you meet its total needs for basic technical, general, continuing, adult, and retraining education.

Research and development technicians are but one facet of the overall technical support picture. We should examine the full scope of positions that comprise the technical support area. So let us expand your horizons to think of your responsibility of training for the entire technical support area. This area includes junior staff personnel with or without degrees, scientific and engineering assistants with or without degrees, direct program technicians, peripheral service technicians such as Health Physics Technicians and Technician Operators. We also have other supporting personnel such as draftsmen and designers, instrument machinists, welders, opticians, fire protection specialists, and administrators. In addition to this, we have the plant service technicians handling steam, electrical and mechanical maintenance, medical technicians, glass

blowers, and clerical personnel. This may sound somewhat like Dr. Seuss with his tome--one fish, two fish, red fish, blue fish; but as in learning to read, all supporting facets must be available to make the research and development operation function.

An example of insatiable demand for curriculum development and trained personnel is the area of plant maintenance men. In a research and development organization, as well as in many diversified manufacturing industries, such a man must have considerably broader knowledge than a specific trade. He needs to understand electricity, controls, steam, heating, air conditioning, refrigeration, elevators, plumbing, etc., because of the wide variety of machinery, air, water, and underground gas and utility supply lines essential to plant operation. At present, the best source of such personnel is men with many years experience in the engineering sections aboard Navy ships. There they have acquired the most diverse and broad education in the total information needed to operate a unitized plant. I would judge that curriculum in plant maintenance is a wide-open educational field for any partially industrialized district that you serve. There must be thousands of high school boys with a jack-of-all-trades bent, who would be formative material for such a course.

As community colleges, you must think on a broader scope than that of only the technician. It behooves you to fill all the possible employment and cultural needs of your area. The degree of post-high school technical knowledge required in an ever-increasing number of positions today necessitates that you develop those living in your community for the employment of the decade whether they continue to reside in your area or not. If your area is to survive economically, its residents must be prepared to work whether they seek employment locally or follow a national pattern. If they are not prepared, your institution will atrophy with your community in an economic as well as a social sense. You must, secondly, meet their increasing cultural requirements as well, now that leisure time will be thrust upon them in greater measure. Much of the latter can be on a continuing education basis. Moreover, there will be an increasing need for the pre-professional curriculum traditionally offered by junior colleges. The student, initially oriented technically-vocationally, will undoubtedly return for those liberal arts aspects of education that he wants on an adult continuing education basis, through company financed assistance plans or on his own. Your community will expect you to take the leadership in developing the curricula that will meet the needs of this and future decades.

An analysis of your own districts will give you a scope of proprietorship considerably more awesome than your capability to fulfill it. The finest contribution that you can make is a well-trained and well-educated young man or woman enabled to make his own way in this increasingly complex technological and social world. Such a graduate will bring praise from the spouse, parents, the employer-user, and the municipal and business organizations that profit from a contributing taxpayer contrasted to a marginal or sub-marginal community member who is a liability to himself as well as to others. These interrelationships are at the heart of your proprietorship. They are also congruent with your ideals and fondest dreams for the type of educational institution your community needs.

Your institutions should be second to none in meeting the educational task that is your unique responsibility. Your community will be following your leadership role--the gauntlet of technical and community college educational proprietorship has been passed on to you.

Your responsibilities in many ways reach deeper into the grass roots of the nation's future than does any other segment of the educational panorama. It has been estimated that 50,000,000 of our citizenry are now engaged in educational pursuit of some form. Ph.D's are probably less than 1 percent of our population; graduate students comprise another modest percentage. Your institutions stand on the horizon much as the Statue of Liberty, beckoning to the major segment of our citizens--"Here is the hope, the bettering of your future; come and achieve; we stand ready for your challenge."

EDUCATIONAL INNOVATION
by
Franklin G. Bouwsma*

There are many different problems we face as administrators when we consider the prospect of educational innovation, but the first decision is yours. It is necessary to shatter inertia, and this can be accomplished only if you, the administrator, decide to innovate. In the field of innovation, the administrator cannot go on forever being a "good egg"; either you hatch or you become rotten. There is no half-way point; there is no such thing as indecisive innovation.

After you have decided to start, you must then make a second corollary decision on who must be involved in planning change. May I recommend that you consider these rules of thumb:

1. Do not go beyond the present state of the art of engineering.

2. Be sure to involve the consumer so you can insure local utilization.

We all know of projects and programs developed by eager enthusiasts in the past decade which failed because of equipment incapabilities. Many times, equipment manufacturers suggested potential automation or educational properties which were unattainable, but in the large majority of instances, the educator or administrator built up an implication in some equipment or program to an idealized state, and it was beyond the capability of the present state of the art of engineering and of education to deliver the suggested results.

It is very easy to get so involved in the aspects of the machinery and its complexities that you will tend to solve problems created by the machines with other more complex machines. We call this an improper gear ratio. The present or opposite trend is to try to use machines or programs so that we can humanize learning, not dehumanize it. A friend once stated our problem as, "How to humanize the scientist and scientize the humanist." The answer to the student's basic query, "Who am I?", is not a teaching machine but a teacher who has time when the student asks the question.

The present state of the art of engineering must be analyzed by a highly competent technical staff. The administrator must ask for their opinion, and when they give it, he should listen. The technical staff should be involved in the design of the change in order to hold it within the bounds of credibility.

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Many of the projects which failed or are now limping dismally to oblivion never involved the consumer in the design of the project. The campuses had the administrative will and the engineering know-how, but the program was designed as a type of academic fallout from on high; and the faculty and the students have successfully outlived the project. Involve your consumers, and they will make a viable project which is their own, and it will surely endure. Design the project for their continued involvement, and after initiating, the administrator can stand to one side while the faculty guides it into tracks which satisfy their needs. Without faculty and student involvement, there is little hope of real success beyond a transitory public relations story or two.

Educational innovation really has four parts of the learning process involved throughout, and the projects will require different variants of each part. You should be aware that every rule of operation has many variables and opposite views which will work well, but these are my operational guides of the past fourteen years.

The first part of the learning process is the professor--the faculty member. He is the content specialist, the inventor of the material, the selector of information, and the guider of student stimuli. It is his task to select and develop that body of material or that subject which the student should probe, sift, or question. He is not necessarily an actor, and frequently his delivery or appearance detracts from the material or distracts the students. Whether or not the professor's delivery is comparable to that of a professional narrator is not of major importance to the faculty member. Faculty orientation is to the content of material presented; this is where years of study are brought to fruition, and this is where the role of the professor cannot be questioned.

The professor must select the subject matter according to proper media and must be very aware of similar projects being developed on other campuses. An Innovations Library of research data in education and available produced materials should be designed for faculty browsing and discussion, and it should be an area designed to be conducive to straying down the path of educational heresy. The many reports and studies crammed into administrative dead files should be displayed there, and a faculty librarian should gather information for the faculty on an inter-library loan basis. We believe that the faculty will lead in innovation if they have the data and the correct information. It is easier to forge into the known, to pioneer down an expressway.

The professional team planning the design for the future should plan the project to give the faculty member a low student ratio so he is available when the student needs him. The many aspects of each subject should be analyzed for group study, group problem-solving, case analysis, programmed rote material, information practice, and concepts to question in addition to other instructional methodology or media. The methodology of epistemology should become a major part of the professorial problem for each course.

The faculty should be involved in the selection of purchased instructional materials. They should pledge a minimum of three years use of the films or tapes purchased during the year. The administration should agree to purchase the materials they have selected after the preview committee and the faculty of the department have voted to purchase them. A system of review of materials at a certain time should be developed so the material will not be out of date. The faculty viewing is not only important for proper selection, but it also creates an awareness of what is being done and gives them a greater sense of professional production. Their higher standard of acceptance will require greater selection and invention on their part and higher production quality on the part of the local production staff.

A skilled, aware faculty is the beginning of the learning process in the educational institution; all other aspects are subservient to their part of the process. Listen to their longings, phobias, and triumphs.

The second part of the learning process is the content. It must be analyzed for the differing student needs and for its ability to satisfy student needs at different times and levels.

The greatest breakthroughs in this century are the ability to store and retrieve information and the fact that we are learning how people learn. The entire educational process in the future will be based on these facts, and now is the time for the faculty to design the subject matter for this future.

Materials should be programmed in small bits in sequence to insure comprehension of the subject. I know this is quite behavioristic, but it works, and more people will tend to learn more efficiently; so it is time to use this first step in organizing material for learning. The early rhetoricians and dialecticians worked out the detail of disposition of materials for the persuasive effect. The dispositio of the future will be the design of the content to insure the acquisition of the desired information. The yellowed notes in chronological order have very little reason for existence if they are not an effective learning methodology.

The content must flow easily from one sequence to another, and tangential forays should be planned in branching form to pique the student in individual study programs. It should be noted that sheer stimulus-response instruction is usually insufferably dull but effective. Care should be taken to develop the more interesting factors of the subject throughout. Other parts of the content should be designed for student stimulation. It should force the student to question. It should be a catalyst to move the student from information to the search for knowledge.

For many years we tried to put information in the student like jam in a jar, and at the end of the year we opened the jar to see how much jam there was. Sometimes the effect was "GIGO"--garbage in, garbage out. In the era of computerized information storage, this instructional system is hopelessly obsolete. The content must stimulate the student

to question, to probe, to sift, and then to solve. Instead of using jam jar instruction, maybe we should put bees in their bonnets and see which way they jump.

The content should be designed for maximum use of stored data applied to the local case studies. The humanized give and take or dialectic must be designed into the content itself to insure student involvement. If information is stored nearby, readily available, we should teach how to find it and how to use it, not how to duplicate it unnecessarily. The Postlethwaite project at Purdue is an example of audiotape exercises in the science program to increase learning ability. It is stored data. Eight mm single concept films in the technical area is an example of stored data. The programmed learning workbook is stored data. Using some teaching machines and some computer-assisted instruction is an effective utilization of stored data in instruction; frequently, however, these projects are extremely expensive page turners. The change in content design is the most difficult problem for the faculty. It is a continuous change.

The student or learner is the third part of the process we have been analyzing. Of course we all are in this category as members of the community of scholars, but at this time we should consider especially that tuition-paying group who give us our daily bread. The student needs professorial empathy. We seldom hear a faculty member or administrator note aloud the desirability of comprehending student needs, but the student is the individual of the future and his individuality is the key to this person's learning. He will accept innovation which will enhance his ability to be an individual in a cipher-prone society. Large group projects should be designed to gain more professorial productivity for more "other-side-of-the-log time."

The students should be tested frequently to continue the improvement of the materials for more effective communication. The goal should be to improve communication so the comprehension is constant at the 100 percent level, and the time spent in study is the bell curve.

Students should analyze the projects and their effectiveness as paying consumers, and their analysis is usually quite sound. Their preferences are quite important, for student motivations can be a guide for a design for greater learner involvement. The students will tend to guide the projects for humanizing at critical learning points; they will oppose dehumanizing violently.

Obviously the fourth part is the media itself or the vehicle or occasion for learning.

The accessibility of instructional materials is a critical part of any Learning Resources Center concept. We have found at Miami-Dade that open instructional carrels, the library study divider stack, the student materials access counter, and a computer printout analysis increased our utilization of audio-visual materials 500 percent in six months. It is

necessary to distribute information widely on availability, and it is necessary to guide the purchase of equipment for a low-maintenance high-performance operation. The faculty should not be required to learn how to operate any equipment, and the student operators should operate professionally.

All media produced locally on the campus should be produced so that there is a faculty approval of all of the aspects of production along the way. This will take more time, but it insures quality production and more utilization. As much as possible, there should be multiple presentation potential for local productions, e.g., a color film has a possibility of presentation as a movie in an auditorium, can be seen as a movie in a classroom, can be reduced to an eight mm film in a student carrel for individual study, and can be seen on a television system in any situation simultaneously; a videotape can go only through a television system.

We find that faculty and student preference is for professional production quality. In order to achieve this comparable quality locally, we have acquired a professional staff. Our faculty and students have voted in favor of these presentations, and we have more faculty-requested projects than we can produce. Our faculty are professionals in their field; we try to give them professional materials.

One of the important things to remember about the use of media is that there are different strengths and weaknesses in each medium, and the content and its use will frequently recommend the proper medium. For many years, we have been videotaping programs which should have been audiotaped with a few visuals and charts passed around through the class. In our present state, we will differentiate between a color videotape and color film production according to ancillary class or student individual study projects. We will also point out the editing problems and solutions and then will decide which is the correct medium. There are differences in media; they should be used sparingly in a course, and different aspects should be used (the long distance expert phone call one week, the programmed learning workbook at certain times, the audiotape notebook one week, etc.).

It is obvious that local and regional libraries of materials are being developed. We have many projects like this in Florida and in the southern region. As long as materials are developed individually, there is no problem, but full courses in the can are on their way out. A library with infinite variety also permits instructional variety in colleges.

The interchangeability of equipment and materials will be critical in the near future. Be aware that in purchase of equipment, the extra dollars may insure your ability to get outside of your classroom walls. You must also be sure the faculty "review and edit" rights are protected for each outside use or library use. The professional rights are vital to every college, and they must be protected by written contract.

The design of building, study space, and classroom should be based on as much flexibility as possible. Unless a carrel or viewing system is flexible, it is soon obsolete for viewing, and study patterns will change daily. In the planning of new spaces for new media, tight engineering specifications and broad educational specifications should be followed.

These, then, are my thoughts on educational innovation; it's up to the administrator to start it, to keep it plausible in terms of engineering, and to insure the involvement of the faculty and students; and the varying parts of the learning process--the professor, the content, the student, and the media should be analyzed for greater learning efficiency and effectiveness. For us as administrators, it will require an innovation. "And, therefore, never send to know for whom the (school) bell tolls; it tolls for thee."

PROBLEMS AND PROSPECTS IN TECHNICAL EDUCATION

by

Harry Broudy*

Vocational education is peculiarly sensitive to the demands of the future. All schooling is to some extent for the future, but that which purports to provide us with the means of earning our livelihood is directly influenced by anticipated changes in the economy and its demands on human resources. In no sector of educational thought, therefore, is the relation between problems and prospects so intimate; determining the prospects is one of its problems. Whereas in general education we seek a formula that will be right for all men at all times, in devising schemes and justifications for vocational education, we must keep in mind thousands of occupations and millions of individuals for each of whom, ideally, there should be an occupation that will exploit his peculiar syndrome of talents at a level just a bit higher than he can hope to reach.

Assuming that the next two decades will extend the fruits of the technological revolution, especially in the direction of not only making products by machine, but also making machines and directing their operation by machines, what problems of policy confront vocational education? What shall be its relation to general education? What shall be its role in the total educational enterprise? What learning outcomes shall it make central, and in what institutions shall they be provided? What shall be the relation of vocational education to the utilization of human resources by the economy of the nation? I shall concentrate my remarks on these and kindred questions rather than on the more technical problems of accomplishing certain outcomes on which, in any event, I have nothing to contribute.

We can get at some of the more general questions by examining the claims of vocational education for a place in the secondary school. The arguments have run something like this:

1. Because the economic life of the social order is so important, everyone ought to be trained for economic productivity <u>in the schools</u>.

2. Failure in one's economic role causes or contributes to delinquency; hence vocational training <u>in the schools</u> is justified on sociological as well as economic grounds.

3. Because so many of our youth do not continue their schooling beyond high school, vocational education ought to be introduced in the early years of the secondary school.

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4. The high schools by their traditional allegiance to a literary, academic, bookish curriculum, have not given the proper attention to vocational training. Hence there should be a change, especially in the direction of secondary school vocational training for the academically limited pupil.

The trouble with the argument from the importance of economic activity is that it does not prove the need for formal vocational education.

The economic life of the Eskimo, for example, is important to the Eskimo, and if the Eskimos did not teach the young the vocational skills of the tribe, there would soon be no Eskimos. This is a truism. The important point is that the necessary occupational training can be accomplished by simple imitation and apprenticeship. No one had to urge the Eskimo to provide this type of education; it was as much a part of the milieu in which the young grew up as ice and snow. For one thing, almost everyone learned about the same occupational roles, although midwives and medicine men might be exceptions.

For another, the tasks comprising a given occupational role were familiar, and the proper procedures could easily be demonstrated. These procedures could be formulated into rules, but the rules were not derived from theory and certainly not from scientific generalizations. Presumably, for all ordinary cases, the existing procedures and rules would ensure success. Extraordinary cases would present a problem. Whether or not the tribe could cope with it was a gamble, a gamble with luck and ingenuity or trial and error. The survival of the Eskimo is witness to the fact that either extraordinary cases were few and not important, or that their luck and ingenuity did not desert them. There is no evidence, at least none known to me, that the Eskimo applied the findings and methods of science to his economic problems. Up to very recent times at least, the know-how needed for the economic well-being of the group could be acquired and perfected without the benefit of formal occupational schooling. The simple moral of this example is that the importance of economic activity does not of itself imply an argument for vocational schools, programs, or curricula any more than the importance of breathing and exercise necessarily justifies schools of physical education.

Nor is it helpful to mix up the need for facilities in vocational schooling that do not exist with the failure of young people to take advantage of the opportunities that do exist. Surely, these are different arguments and apply to quite different situations. In the first situation, one is saying that James and Peter wish to become electronic technicians, but that regrettably they can find no course or no school in which to carry on the requisite studies. In the second situation, one may be scolding Susan and Mary for electing a classical course in high school when their abilities and station in life (as determined by scientific prognosis) point to the advisability of a business course. The answer to the problems of James and Peter lie within the educational

wisdom and will of the community, but what is one to do with the alleged wrongheadedness of Susan and Mary?

The argument that we ought to use vocational education as a preventive of delinquency is both appealing and financially astute because almost everybody is against delinquency. But at most, keeping the young out of jail is an indirect goal of vocational education, as it is of all other social institutions; once it is made a primary goal, the distinctive role of vocational education in the educational system is seriously compromised. For example, it can be claimed that certain skills and knowledge cannot be acquired without schooling, but that schooling of any kind is a necessary condition for health, wealth or good character is difficult to take seriously.

The last argument, viz., that the traditional allegiance of the traditional high school to academic subjects is no longer an adequate preparation for the world of work for most of our young people, will also have to be reexamined in the light of what the world of work may look like in the next quarter of a century, and to this I now turn.

As the western world (and we may as well anticipate a bit and say the whole world) works out the logic of mass production based on scientific technology to the end, bitter or otherwise, education for vocation becomes both more common and more general, on the one hand, and more specialized and diversified, on the other. This sounds paradoxical, but then we live in a paradoxical age.

To say that vocational education will become more diversified and specialized needs no elaboration. To say that it has to become more general and common means that it will depend increasingly on the manipulation of symbols as formulated in language, science, and mathematics instead of things. As someone has said, "It takes a ton of paper to make a ton of steel," and in such an industrial system, symbolic workers are as important as manual workers. The symbolic skills, however, are at the heart of common general education, and all over Europe, as well as in the United States, the recognition is growing that more general education for the common man is indispensable if a country hopes to stay in the industrial competition.

The same conclusion is reached when the obsolescence of specific job training is considered. I have been told that in the years to come, men will work only three days a week on their present job and put in three more studying for a new job. So much for the dream of luxurious leisure. The flexibility required for frequent retraining is impossible to achieve without a solid training in the symbolic skills and basic concepts that make up general education.

Finally, there is the educational fact that young people who have a mind to become technicians in any one of a dozen fields have to undertake post-secondary schooling that requires virtually the same competencies in science, language, and mathematics as does the engineering

curriculum. In summary, the prospect is for more and more specialization and diversification, but for many of these specialties to have a short life. Common general education alone will enable men to make the rapid adaptations to new processes, new materials, new forms of energy, and new forms of production.

If these projections are in the right direction, then certain changes in the general school system will follow:

The secondary school as the proper place for vocational education may be seriously questioned. First, it is doubtful that the ordinary secondary school can provide the kind of program that will be adequate to both the increased diversity of occupations and the greater commonality of the general education that is a prerequisite for them.

The reasons for this doubt are fairly simple. A sound education in the general studies takes time and concentrated effort. Those who admire European secondary education should be reminded that even with a highly selected study body, gymnasia, lycees, and public schools do little else than teach the basic studies. If basic education is to be done thoroughly, the secondary school cannot do anything else, not even vocational training.

The other reason is that to do the kind of high-level training required by modern industry, for a wide variety of specialties, calls for a concentration of resources and staff that very few secondary schools can command. In short, what America has tried to do with its comprehensive high school will probably have to be done by a chain of regional post-secondary institutes devoted exclusively to vocational training in both depth and breadth.

Presumably, such institutes would supply training for the occupations lying just below the professions, although the possibility of transfer into professional curricula from the institutes need not be precluded. Relieved of the need to provide general secondary education, these institutes could utilize their resources for high quality specialized vocational training; relieved of the need to "dabble" in vocational training, the secondary schools could, in turn, make it unnecessary for vocational schools to give remedial work in language, science, and mathematics. I have used the word, "dabble," advertently, because most American secondary schools confine their vocational offerings to the commercial course and a little training in one of the trades or agriculture. Most American secondary schools are too small to do otherwise.

It will be objected that this division of labor is unrealistic and even wasteful. Youngsters who are unhappy with bookwork, it is argued, should begin vocational training early, say at the age of fourteen or fifteen; any further time spent on general studies would not only be a waste of time, but might even drive them out of school.

Against this objection certain observations are in order: First, among dropouts from high school, one finds all grades of intelligence,

not simply the dullards. In the second place, if the lower prestige occupations are to be made more desirable, they too will require higher intellectual competence, a point to be discussed more fully below. Third, we have not yet exhausted the pedagogical means for teaching the general studies to the lower reaches of intelligence. Fourth, the problem of rescuing children who have been radically deformed by their environment is a problem for social therapy, and the responsibility for it rests primarily on the Department of Welfare and secondarily on all social institutions rather than on vocational educators.

Finally, and most important, is the fact that to utilize the benefits of large-scale machine industry safely and productively, we need not only a high order of vocational skill, but also a high order of citizenship and a high order of personal development. Without these, the effects of automation may be disastrous, not only economically but socially and psychologically as well. Contrary to first impressions, the ultimate development of mass production is not a maximum of mediocre uniformity. It is rather the volume production of an array of products exhibiting the widest possible diversity. The trick of mass production is not to turn out cheap suits in three colors and four sizes. That is only the first step. Technology comes into its own when without raising unit costs, it can turn out suits in twenty-five colors and twenty sizes. Without the sensitive as well as voracious consumer, the high productivity of technological progress cannot be accelerated sufficiently to escape the drag of overproduction.

All of these considerations militate against the argument that general education is for the classes and vocational education is for the masses. One of the fortunate factors in the situation is that automation technology can provide the time and resources for the new educational formula. We can use the added productivity of a technologically sophisticated culture to maintain and exploit it for further benefits.

Britain's mild flirtation with the comprehensive secondary school, while admirable in intent, may be misguided, as indeed all flirtations are likely to be. The times, it seems to me, point to more high-grade general education for all young people rather than a greater variety of offerings as a means of providing all young people with an inducement to a longer and more interesting stay in school. The word, "comprehensive," should apply to the population being schooled rather than to an array of curricula.

If this view is correct, vocational education for the immediate future is important in more than a truistic sense. It is important in the sense that it has to become formal and more consciously and extensively based on theory. The elaboration of knowledge in interdisciplinary form may well have a profound effect on the patterns of vocational training. Solid state physics, biochemistry, and a host of other fields make the preparation of an electronic technician, for example, far more complicated than it used to be. Working in automated factories will, no doubt, create occupational patterns of its own. The service occupations also will call for theoretical scrutiny and rethinking.

These considerations force the conclusion that vocational education faces responsibilities that go beyond constructing curricula and training personnel to teach them, and it may well be that these new functions will radically alter the shape of even its instructional role. Somewhere in our educational system there must be men who not only know how to teach auto mechanics or electronics (although we can never have too many of these) but who also understand the total economy and its relation to the social order.

As one example of the kind of thinking one might expect the vocational educator to be concerned with is the upgrading of occupations that are socially necessary but which do not enjoy sufficient social status to attract a sufficient number of workers.

In one sense, this upgrading is not the responsibility of vocational education. The status of an occupation is the resultant of many factors. In another sense, however, the way a person is trained for a job has a good deal to do with the status of the job in the occupational hierarchy.

I am not now thinking of the euphemisms by which grave diggers evolved into undertakers and then into morticians, and by which janitors are transmuted into custodial engineers. This is semantic abracadabra, although like all abracadabra, not without influence. More fundamental are the mechanisms by which an unpleasant but socially important task is made tolerable and honorable. Nursing, cleaning, disposal of the dead and of refuse, and household and personal services of many sorts fall into this category. There is a constant high demand for such services, but they are unpleasant and tend to be low on the social scale. However, they are not all equally low. Nursing is a prime example of a calling that has risen on the social scale through technicalization, routinization, and intellectualization.

For there is no task so distasteful that routine, skill, a degree, and a uniform cannot transform. The sweeper of dung is low on the occupational scale; the technician who examines feces in the laboratory is not. Skill, knowledge, standardized procedures justified by knowledge, together with a uniform, help to separate the unpleasantness of the task from the character of the performer, or to put it inelegantly, from rubbing off on him.

For example, it is important that the performer of a personal service not be stigmatized as a body servant, owing personal fealty to a master. Contrary to the common impression, depersonalization, not personalization, is the key to vocational status. The loyalty of the high-grade worker must be to the task, not to the person served. Even when an agency or firm boasts of "personalized" service, the personalization is so managed and routinized that it is really depersonalized. The sleekly gracious airline stewardess is about as good an example as comes to mind. Any male traveler who construes her interest in him as personal is soon disillusioned. This deflates the ego of the customer, but it does wonders for the status of the occupation and the ego of the worker.

Thus, although vocational educators cannot by simply taking thought, raise the social status of housework, practical nursing, gardening, and the like, they can by taking thought, explore the possibilities of rationalizing, standardizing, depersonalizing, and insofar as possible, intellectualizing these occupations. I take it that such study is properly within the province of graduate students and research workers in vocational education.

But vocational educators may have to take on an even broader role in educational statesmanship. For it is doubtful that we can ever again afford lags of fifteen or twenty years between the manpower needs of the nation and the educational facilities for meeting them. On the contrary, to stay even, educational strategy should have a lead time of at least a decade.

In a culture such as that of the United States, where economic planning on a national level is not looked upon with favor (although no industrial organization would be caught dead without its plans for the future), it is difficult to project manpower needs and to translate these into educational activities.

What sort of training would it take to produce a cadre of vocational educators who could do this sort of planning; who could interpret pervasive trends in the work patterns of our culture; who could understand the impact of new discoveries and processes for the economic future? For the good of the nation, industry, and the world itself, such vocational statesmen should be sitting on boards of research and development in every major firm and governmental agency. Right now there may be possibilities aborning that ought to be translated into educational designs, a task that neither the industrialist, nor the researcher, nor the government official is trained to do.

It is for this reason that at the professional level, vocational educators need study, in the philosophical, psychological, historical, and sociological aspects of educational policy, curriculum design, organization and support, and teaching-learning as well as technical training. The phrase, "professional level," is a calculated qualification. Workers in the field who think of themselves solely as technicians perhaps can dispense with such studies. Given familiarity with the processes to be taught and some teaching skill, they can do their job without losing sleep over the vagaries of the culture. They are, in a sense, not very different from the boys and girls they are teaching, for it is a case of an experienced technician teaching a novice technician. Such men are valuable and indeed indispensable. Vocational education is happy to lure some of them away from industry for pedagogical purposes. However, such men will no more be able to shape educational strategy than will sergeants in the army or a foreman in the factory. If it takes a ton of paperwork to make a ton of steel, it will take more and more knowledge about the world to understand the world of work, and it will take even more if educators aspire to anything more than catching up with the dynamics of economic change. We are, all of us, therefore, condemned to develop our powers of

knowledge and wisdom to a degree hitherto believed to be impossible for the common man. Strange as it may seem, it is the machine that may in the last act force us to become human.

CONSIDERATIONS IN PLANNING AND ORGANIZING
A NEW INSTITUTION OFFERING
TECHNICAL EDUCATION
by
Frank Chambers*

A new institution always presents unique problems. Consequently, there is no formula for an "instant" college. Obviously, the establishment of a new college will be influenced by the laws establishing public colleges; the organization of higher education in the state; and the size, sociological setting, and purposes of the college.

Lamar Johnson suggests that the chief administrator's major tasks fall into six areas: curriculum and instruction, student personnel, staff personnel, finance, plant and facilities, and community service and relations.

The agreed-upon purposes of the college are achieved through the planning, developing, and preparation of the curriculum, and the instruction. Large numbers of needed and desirable curriculums may be identified, but as curriculums proliferate, financial cost may increase in direct ratio. In this area, other problems include the stretching of a small faculty over a large number of courses, the development of an "instant" library, the stocking of appropriate numbers of texts for day and evening students, and the preparation of equipment and supply lists.

Students need to be enrolled, counseled, organized, and provided with out-of-class services. The student personnel officer is faced with the absence of a student government to aid him. This may force him to establish authoritarian administration and minimize eventual student self-government.

In staffing the college, the chief administrator must answer these questions and solve their inherent problems:

1. What is an appropriate salary schedule?

2. Is it ethical to recruit leadership from other institutions?

3. What should be the organization of departments?

4. Should chairmen be appointed immediately or after the staff has been evaluated?

Academic regulations and policies governing the staff must be

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established immediately, and faculty participation must be invited; but the question is, "How?"

Additionally, the new and inexperienced faculty will vary in direct proportion to the number of staff. How is unity of direction given in the carrying out of the purposes of the institution?

Securing and administering funds to pay the operational and capital outlay of the costs of the college can be a dilemma. It can be influenced by the concepts of the community college role, state leadership, and the relative support of state and local support and student tuition. Comparison with other two-year colleges does not provide a solution. The nature of the college plant, kinds of curriculums, student population, and the evening program are a few of the variables that necessitate extensive financial study.

It is necessary to build facilities that will accommodate constantly changing teaching techniques and will justify the cost and satisfy the goals of design and aesthetics. The problems can be resolved through the selection of an enthusiastic and competent architect, the involvement of staff, visits to other campuses, and reference to standard works on community college planning and development. The development of a master plan, based upon projected enrollment, curriculums, and college purposes, is of great assistance.

Enlisting the interest, support, and participation of the community in the college is a factor of time versus adequate preparation. The preparation of an outstanding program to explain the college is worth the time and effort in the good public relations returned to the institution.

It has become the goal of many states to place a community college within commuting distance of all the people. This goal constitutes a dilemma at the operating level. Unless adequate financing is available, the programs of many of these colleges must be woefully weak or exorbitantly high in cost.

The college that does not provide a diversity of curriculums will limit the students it can serve. On the other hand, if the student must pay room and board to attend a comprehensive college, the result in cost will be a barrier to his education. It appears that the establishment of a community college within commuting distance of every family may not be a goal consistent with the purposes of community colleges.

IMPLICATIONS AND IMPACT OF THE VOCATIONAL EDUCATION ACT OF 1963**

by

Roy W. Dugger*

From 1962 to 1965, it was my privilege to serve as Director of the Manpower Development and Training Program and as Deputy Assistant Commissioner for Vocational and Technical Education in the U. S. Office of Education. Some of my most pleasant experiences while in Washington, D. C., were in working with members of the General Subcommittee on Education and with staff members of this Subcommittee, in the expansion and improvement of vocational and technical education opportunities for youth and adults throughout our great nation. One of the very fine pieces of legislation which the distinguished chairman of this Subcommittee and his associates sponsored was the Vocational Education Act of 1963, P. L. 88-210.

Today, I feel grateful and humble that you have invited me to share with you some personal views regarding the impact of the Vocational Education Act of 1963 on occupational training and retraining opportunities for all of our people, and to reason with you about possible solutions to problems which face youth and adults preparing to enter, re-enter, or effectively meet new and emerging demands of the changing world of work.

If the Subcommittee would indulge me, a brief description of the James Connally Technical Institute of Texas A & M University could serve as one example of the impact the Vocational Education Act of 1963 is having on vocational skill development and technical training. Under the able leadership of the Governor of Texas and through the wisdom of perceptive leaders in the Texas Legislature, Texas A & M University was authorized by the 59th Texas Legislature to establish the James Connally Technical Institute on James Connally Air Force Base near Waco, Texas. This decision was influenced significantly by findings of the Governor's Committee on Education Beyond the High School, which reported that the largest single gap in the Texas system of education beyond high school is in the providing of scientific and engineering technicians for research laboratories, businesses, industries, agriculture, and health centers of the state.

Facilities on James Connally Air Force Base are being made available for the campus of the Technical Institute as the U. S. Air Force mission is phased out at this base. The problem of financing the many remaining needs of this newly-activated educational institution will effectively illustrate the imperative requirement for federal support of such

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**Oklahoma State University. This report was also presented to the General Subcommittee on Education of the Committee on Education and Labor, House of Representatives, United States Congress, Wednesday, June 15, 1966.

undertakings. Specifically, sources of funding are required for: (1) research to identify vocational skill development and technical training needs of Texas business and industry; (2) modification of buildings; (3) purchase of modern laboratory and shop equipment; (4) instructional equipment installation; (5) teacher salaries; (6) teacher training; (7) student counseling; (8) work-study activities for students who must earn while they learn; (9) student loans; and (10) evaluation of program effectiveness. The fulfillment of these needs is a joint endeavor of the state of Texas through Texas A & M University and of the Federal Government under provisions of legislation such as the Vocational Education Act of 1963 and of the National Vocational Student Loan Insurance Act of 1965. Classes were started January 11, 1966. Since that date, 60 full-time and more than 300 part-time students have enrolled. By September 1966, there will likely be 500 full-time students. Enrollment will continue to increase while the U. S. Air Force mission continues to phase out between now and June 30, 1968, when there will be facilities available for 3,500 full-time and 1,500 part-time students. In all courses offered at the James Connally Technical Institute, the primary objective is to enable men and women to escape the scourge of unemployability and participate effectively in the changing world of work.

The James Connally Technical Institute, a civilian institution, is unique since it is being developed and operated on an active U. S. Air Force Base. Through the enthusiastic cooperation of federal officials in the Department of Defense, General Services Administration, Department of Health, Education, and Welfare, Department of Labor, and Veterans Administration in this pilot program, all instructional target dates are being met. Senior military personnel in the Tactical Air Command and in the Air Training Command have been particularly helpful in starting this technical institute which will provide many courses designed to give civilians vocational skills and technical competencies that are critically needed in the military or which are necessary for national defense, industrial development, and business expansion.

While the Vocational Education Act of 1963 provides a basic framework that is stimulating the expansion and improvement of vocational and technical education in high schools and post-high school institutions, Texas is finding itself in a position similar to that reported in many other states, that of being unable to meet continued essential expansion and improvement needs with the limited funds authorized and appropriated. To meet the growing demands of the exploding youthful population for occupational training and the essential needs of adults for training and retraining, federal participation through the Vocational Education Act in the amount of $400,000,000 is necessary. This need for funds is in accord with the amount recommended in the 1962 report by the Panel of Consultants on Vocational Education requested by the President of the United States. This report includes the findings of the distinguished panel after making intensive studies of vocational and technical education in the United States during the 1961-62 period. Without an increase

in the federal authorizations and appropriations to the $400,000,000 level, many of the youth and adults of our nation and my state will be denied the opportunity of learning to earn enough to provide a satisfactory level of living for themselves and their families.

Additional funds are essential to the success of the vocational and technical education program which is being expanded and greatly improved under the provisions of the Vocational Education Act of 1963. But more money alone is not a guarantee that vocational and technical programs will meet the needs of all of our people in every community of our nation. There are critical problems which may require amendments to the Vocational Education Act of 1963 if the Congress is to be assured that vocational and technical education is to keep vocational skill development and technical training in pace with the demands of our growing economy and dynamic society. The following are among those problems which are evident:

Problem 1.

Teacher shortage.-A National Occupational Development Fund is needed provide teacher stipends and teacher development programs for vocational and technical teachers in much the same way the National Science Foundation provides for this in engineering and science. This would permit vocational and technical teachers to learn what to teach, how to teach it, and escape the plague of traditionalism which could leave their students unemployable.

Problem 2.

Limited occupational information.-A National Occupational Development Fund could stimulate the implementation of continuing qualitative studies of clusters of occupations. These studies are essential to assure that the content of vocational and technical curricula will properly prepare youth and adults for work in their time.

Problem 3.

Archaic teaching methods, procedures and techniques.-Research in education in general, and in vocational and technical education in particular, needs to be coordinated on somewhat the same basis that research in agricultural production, packaging, storing, and distribution is coordinated. Traditional public and private educational institutions cannot cope with the exploding demands for the storing and rapid dissemination of knowledge unless a major break-through in effective teaching methods, procedures, and techniques is achieved. Teaching must be audio-visualized, mechanized, and automated.

Problem 4.

Rigid matching requirements.-Matching in kind would permit greater flexibility in program development, expansion, and improvement.

Problem 5.

Inflexible fiscal procedures.-A few states and many schools are handicapped when funds are not advanced for approved vocational and technical programs. They just do not have sufficient state and local funds available to pay the costs of a program and then await reimbursement which may be delayed for three months to a year.

Problem 6.

Inadequate state and area leadership.-Funds are needed to pay 100 percent of the cost of personnel and equipment necessary to assure enthusiastic administrative leadership and adequate program supervision in state vocational education agencies and in approved area vocational schools. A program of this type appears essential to assure that competent leaders are available to pursue courses of excellence in preparation for the changing world of work.

Problem 7.

Poor articulation of vocational technical education.-Many American publics that are affected by vocational and technical education have been asleep. The majority of vocational and technical educators have thought themselves too busy to articulate occupational training with its reward in careers to all but a few of their publics. The President's Panel of Consultants on Vocational Education estimated that 80 percent of the population need specialized occupational training. A vigorous campaign is needed to identify in the minds of all Americans the dignity of work and the joy of learning to work effectively with success and happiness.

Problem 8.

Failure to reach the hard to teach.-One of the greatest failures of our time has been the reluctance to develop experimental, demonstration, and pilot programs, including, but not limited to, residential vocational schools designed to determine how to help youth and adults with severe socio-economic handicaps cope with their problems and become productive workers. Funds to pay 100 percent of the costs of these programs are essential if society is to avoid the high cost of a welfare life for many of these hard to reach and hard to teach people.

Problem 9.

Traditional school schedules.-The traditional nine-month school year and six-hour school day leaves many school facilities vacant a lot of the time. This also requires business and industry to absorb more people into the world of work in June of each year than can be efficiently accommodated in one short period. Vocational and technical education in particular should be offered on a year-around basis with course content and length tailored to the requirements of business, industry and the needs of the students.

Problem 10.

Inadequate student assistance.-The work-study program needs to be expanded significantly. In addition, a vocational and technical student loan program is needed to assist both youth and adults. The amount of the loan available to a young person should enable him to pay his own necessary living and school expenses, carry a reasonable rate of interest, and have a loan forgiveness feature if a specified amount of time is served on active duty with the military forces or public health service or in business or industry in an occupation designated as vital to national defense. The amount of the loan available to an adult with dependents should enable him to pay the necessary living expenses for himself and his dependents as well as school expenses, carry a reasonable rate of interest, and have a loan forgiveness feature if a specified amount of time is served on active duty with the military forces or public health service or in business or industry in an occupation vital to national defense.

The problems listed and the observations made are not intended to be all inclusive or exclusive. They are not listed in any particular order of importance. They are some of the problems encountered in developing a new technical institute, which will eventually include vocational skill development and technical education in fifty occupational fields. Also, professional associates in Texas and elsewhere have indicated these are some of the problems faced by them in their pursuit of excellence in training our population for the changing world of work.

If the Subcommittee will permit me one final privilege, I would like to provide each member with a copy of the Bulletin of the James Connally Technical Institute of Texas A & M University. Your comments and suggestions regarding our attempt to develop a model technical institute will be helpful and welcome. We will be glad to have members of the Subcommittee visit us and our friends in the United States Air Force at Waco to observe how the program you stimulated through the Vocational Education Act of 1963 is helping men and women, young and old, develop vocational skills and technical competencies needed in business expansion, industrial development, and national security.

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PROGRAM PATTERNS
AND
FUNDAMENTAL KNOWLEDGES

by

Lynn A. Emerson*

Technical education attempts to change the behavior of persons, to prepare people for change, to develop within people an attitude for scientific approach, and to serve persons. The persons to be served include: high school youth, post-high school students, high school graduates and drop-outs, college drop-outs, employed persons, and capable students with practical interests in a technology and in a specific skill. A job of technical education is to "turn out" skilled students.

The types of technical occupations below the professional level include: the low-level, narrow scope technical occupations; the technical specialist; the engineering technician; and the industrial technician.

Students need to develop competencies at job analysis of those occupations that involve manipulation, related work experiences, and related knowledge, and the students need to identify clusters of occupations.

In the development of curricula for technical education, it is important to understand that a technician must: (1) diagnose situations; (2) use and read technical materials and handbooks; (3) make decisions relative to technical problems; (4) use a variety of instruments; (5) interpret plans and drawings; (6) visualize and design creatively; (7) understand equipment and materials; (8) make cost analyses; (9) render technical assistance to other personnel; and (10) supervise and communicate with personnel.

Curriculum is an integrated body of educational content, and procedures are usually "broken down" into courses designed to help a person to accomplish a goal. In technical education, the goals are: (1) preparation for the entry job; (2) advancement in the job; and (3) the encouragement for further study.

To achieve this, the student needs technical training, laboratory work, and classroom instruction in applied mathematics and science, in ancillary fields, and in human relations.

Curriculum is based on the method of learning, which includes: sensory impressions, readiness and stimulation, maintained interest, and favorable conditions for learning. We learn by doing and by understanding and by taking one step at a time.

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**Rutgers - The State University.

The procedure for curriculum development involves: (1) setting up objectives; (2) determining and analyzing job clusters; (3) establishing entrance requirements; (4) developing curriculum controls; (5) grouping content into areas; (6) identifying tentative course titles; (7) allocating content areas; (8) identifying types of instruction; (9) determining course lengths and instructional sequence; (10) allocating semester terms to courses; (11) making tentative time schedules; and (12) revising courses and sequences when necessary.

ELECTRO-MECHANICAL TECHNOLOGY
A NEW CURRICULUM THROUGH
COMBINING EXISTING
TECHNOLOGY COURSE
WORK
by
Austin E. Fribance*

The field of electro-mechanical technology is a new and growing field of technical endeavor. Many of the important questions concerning this new occupational area are still unanswered. Some of the fundamental questions that need to be answered are as follows:

1. Is there a real need in industry for the electro-mechanical technician?

2. If this need exists, what educational experiences can best train this new kind of technician?

The answer to the first question seems to be an overwhelming, "Yes." A survey of some twenty-six industrial firms revealed that twenty-two of these firms presently employed some form of electro-mechanical technicians. Of the four remaining firms which indicated that they did not employ electro-mechanical technicians, two of them were engaged in the aero-space industry, which, by and large, considered the majority of its technician work to be electronic in nature.

What technical foundations and skills must the electro-mechanical technician have? After surveying industries which employ electro-mechanical technicians, it appears that this person must have fundamental competencies in the areas of electrical-electronic technology, mechanical technology, instrumentation technology, and optics. The problem that is immediately visible to the technical educator is one of trying to cover these fundamental areas and cover them well in the short period of two years. The conceptual framework of theory and the accompanying laboratory skills must be developed simultaneously in the trainee. In this way, the technician develops more or less equal capabilities in all of the technical areas rather than having strengths in one technical area and weaknesses in others. By feeling equally at home in all of the technical areas, the electro-mechanical technician should look for the best solution to a technical problem, whether the solution is primarily mechanical, electrical, optical, or any combination of these approaches.

Companies that train and develop their own electro-mechanical technicians by company training programs and on-the-job training experiences, try to achieve this technological balance in the technician in several

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different ways. For example, one of the nation's leading manufacturers of data processing equipment develops its electro-mechanical technicians by employing mechanical technicians and giving them the necessary training they need in electronics and physics, with emphasis in optics and the study of light. This method of training technicians in industry seems to be somewhat typical. A company or industry that needs certain kinds of technicians for special kinds of unique jobs generally employs technicians trained in one of the connventional fields such as electronics, mechanical technology, or instrumentation technology, and then adds the necessary specialized training through on-the-job or special company sponsored training experiences to develop the new breed of technician that meets their special job demands.

Industry has great need for electro-mechanical technicians. In the San Francisco Bay area alone, employers are traveling thousands of miles in an effort to recruit this kind of technician. Salary schedules for competent associate degree electro-mechanical technicians with industrial experience ranged as high as $14,400 per year for men with straight technical assignments and no supervisory responsibilities. Numerous companies indicated that they were limited in their plans for future expansion, primarily because of the lack of electro-mechanical technicians.

Employers that were interviewed indicated that the successful electro-mechanical technician must have certain characteristics. One essential skill needed by the technician is the ability to communicate. He must be able to express himself both orally and with the written word. A second requirement indicated by the industry is that the technician have a keen analytical ability which would enable him to analyze technical problems and arrive at tenable solutions based upon his broad technical background.

With regard to technical competencies required of the electro-mechanical technician, a sound, in-depth background in both physics and mathematics (including some applied calculus) is essential. In addition, a fundamental understanding of the principles of electricity and electronics is essential foundation material in any modern technology being taught today. Almost all of the newer and emerging technologies, such as biomedical technology or instrumentation technology, start with this fundamental background of mathematics, science, and electricity-electronics, and build from that foundation into the desired field of technical speciality.

The philosophy underlying the newly developed electro-mechanical technology curriculum is that of a totally integrated curriculum designed to meet the needs of the student. Each subject in the curriculum touches every other subject in terms of application, problem solution, and the development of analytical skills. This is done by presenting the various technological principles in each course so that they relate to each other in focusing upon a problem solution. No technical subject stands alone in the curriculum. That is, no course is

taught without regard to how it might be enhanced and in turn enhance the concepts being learned in other courses.

In electro-mechanical technology, as in all of the new and emerging technologies, it is essential that the technician have a broad and basic understanding of many of the areas of technology and science. An example of this need is in the field of optics. In most of the new and emerging technical occupations, a technician is expected to know something about the principles of optics. One is expected to know the fundamental concepts of engineering stresses and the simple mathematical calculations involved in making stress calculations. The technician is expected to have some knowledge of chemistry and how the principles of chemistry might provide solutions in areas of materials selection. In the fields related to instrumentation, basic knowledge in electricity, electronics, pneumatics and hydraulics is essential for the technician to be able to function as expected. Obviously, a technician cannot be expected to be an expert in all of these technical fields. However, he must have some basic knowledge of all of these fields of technology and how they might work together to provide the answers he is seeking. It is becoming increasingly important for today's technician to have some functional knowledge of computer programming and data processing. In addition to all of these cognitive skills, the technician is expected to have a high degree of motor skill development and manual dexterity.

An electro-mechanical technology curriculum based upon these broad requirements would cover approximately two calendar years. The general content of such a training program would consist of approximately 25 percent subject matter in the area of electricity-electronics concepts, 25 percent course work in the area of mechanical-related technology, 25 percent course work related to mathematics and science; and approximately 25 percent of the curriculum time would be devoted to general education subjects, such as communication skills and humanities. A curriculum with this curricular distribution seems to meet the consensus recommendation of industries which employ electro-mechanical technicians.

The computer industry expressed a critical need for large numbers of electro-mechanical technicians. This is indicative of industry's present and projected needs of associate degree electro-mechanical technicians. These technicians are needed to affect the technical change from conventional circuitry to printed and integrated modular circuits that will be utilized in I. B. M.'s late generation data processing devices. The computer office machine industry conservatively estimates a need for some 65,000 electro-mechanical technicians within the next several years.

An example of some exotic applications where electro-mechanically trained technicians are needed by industry, may be observed at the Stanford Research Institute. In one research project at this institution, over a million electronic components are being integrated into a module no larger than one square inch. In the A. E. C. laboratory at Livermore, California, technicians are working with ionized gases at fantastically high pressures. These are but a few of the new and emerging

technical applications which will require new kinds of engineering technicians.

At the present time, there is a shortage of engineering technician manpower in nearly all fields of the older and more conventional kinds of engineering-related technologies. With the intense demand for great quantities of engineering technicians in the new and emerging areas of engineering technology such as electro-mechanical technology, the national engineering technology manpower problem becomes even more critical. If technical education is to meet this challenge, sound programs based upon the actual needs of industry must be developed and initiated to meet the anticipated technical manpower demands.

*MATHEMATICS IN THE TECHNICAL PROGRAM
by
N. D. Griffin*

The Regular or Conventional College Mathematics versus Applied Technical Mathematics

Most regular college mathematics courses of the freshman and sophomore years are preparatory in nature and emphasize the development of mathematical laws, formulas, and abstract ideas. Usually, the students are expected to develop these formulas and abstract ideas as a part of each test. This is important because the mathematics courses which follow are based upon these concepts. Also, many of the students will be teaching mathematics and should be able to develop this mathematical theory.

Technical institute students who rank high in mathematics on the college entrance tests and who have done well in high school mathematics, should be encouraged to enroll in the regular college mathematics courses. Many of this group of students will be interested in doing work leading to advanced degrees after they complete the technical institute work. They should be advised that applied mathematics is terminal in nature and will not transfer into many advanced degree programs. All educators should encourage the students under their supervision to develop their capabilities and interests to the highest possible level.

College algebra and trigonometry will automatically substitute for the applied technical mathematics, Tec 115 and Tec 125, here at the Oklahoma State Technical Institute. The regular college analytic geometry, differential and integral calculus will substitute for the applied calculus, Tec 135. Students who do well in the regular college mathematics usually have the ability to apply the mathematics in their technical institute courses.

Why teach applied technical mathematics.-Many students of average ability or below average ability soon become disillusioned and discouraged by the rigorous treatment of the abstract ideas of the conventional college mathematics courses and drop out of school. Most of these students who are willing to work do well in applied mathematics courses. They are expected to understand the theory involved when developed and explained by the instructor, but are not expected to develop it themselves on tests. The emphasis is on the use of the theory and formulas in solving practical problems, and the students are expected to have the ability to solve these problems.

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The instructor of applied mathematics should have a broad background of training and experience from which to draw useful applications of the theory he teaches. The language and illustrations he uses should be simple. Illustration: Solve the formula $I=P(1+r)^n$. He should have the tendency to over-teach the theoretical material covered rather than leave too much to be thought out by the student. However, he should expect the students to attain high standards of performance when applying the theory and formulas to practical problems.

Coordination of the Mathematics with the Technical Content of the Specialized Technical Courses

The content of the mathematics courses and the sequence in which it is taught should be determined by the technical department heads and the mathematics instructors as a cooperative effort. No material should be included just because it is good to know or because the instructor likes to teach it. In a two-year program, only the essential material should be taught, because the time element will eliminate many things that are good to know but are not essential.

The sequence in which the mathematical content of the courses is taught may be altered to meet the needs of the students in their major subjects. These changes should be made when the need arises, if they do not present too much difficulty in teaching the content of the mathematics course. (Course outline for Tec 125).

Calculus in the curriculum.-Should calculus be taught in the two-year technical institute? Calculus should be taught if the instructors in the specialized course can and will use it in presenting the content of their courses in a more systematic method and to a greater depth of understanding than would be possible without it. However, if the instructors of the specialized courses need only a small part of the calculus, and if this part can be taught in a fraction of the time and with a fraction of the student effort that would be required in a separate calculus course, then it should be taught as a part of the specialized course.

The following are not valid reasons for teaching calculus as a part of any technical curriculum.

1. Calculus in the curriculum gives prestige to the institution.

2. The accrediting agencies like to see it in the curriculum.

3. It looks good in the advertising and on the curriculum.

4. Employers say it is good to know.

5. The instructor likes to teach calculus.

The good students in any technical curriculum should be permitted to take the applied calculus as an elective if they wish. One of the best ways to kill the interest of the majority of the students in a technology is to require calculus if it is not used in teaching the specialized courses.

Remedial Subjects

Many high school students in our part of the country do not plan to attend any post-high school education institution. Their parents and teachers do not insist that they take courses in high school that will prepare them to enter this kind of training; but as soon as they receive their high school diplomas and realize that most of the other high school students plan to enter some type of post-high school training, they also want to do the same. They now have the desire but are not prepared. Remedial English 105 is offered by the University and Remedial Mathematics 103 is offered by the technical institute especially for this group of students.

They receive no credit toward graduation for this work, but on completion of these courses, they may enter the technical institute work where they become average students. Most of these students realize that this is their last opportunity to receive post-high school educational training; and they are usually a serious, hard working group who make good technicians.

Conclusion

Applied technical mathematics should be a part of the curriculum of every technical institute. It should be taught by a technical institute faculty member who has the training, experience, desire, and ability to make the applied mathematics both interesting, challenging, and rewarding to technical institute students.

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PROGRAM PLANNING AND CURRICULUM DEVELOPMENT
by
Richard H. Hagemeyer*

We all have in our possession, either here or in our offices, all the old and latest materials published on the subject of program planning and curriculum development by the experts in the field. We have all read them or can read them, so I am going to let you get your technical information on the subject from these scholars. I am going to generalize about program and curriculum planning from the practical standpoint and hope that I can generate enough controversy and differences of opinion so that we will have some heated discussions in the period to follow.

I am going to classify my points as "myths," for want of a better word, to describe commonly used theoretical statements that do not always work in practice.

Myth 1.-New programs or curricula arise out of a felt community need as expressed by community leaders.

Is this the way that new programs are planned and developed? Theory says, "Yes"--in practice it is a wide-awake director, teacher, counselor, or president who often plants the original idea in the minds of community leaders. After giving them the idea, the wise administrator then provides the way they can learn more about their idea, even to the extent of providing a little fertilizer occasionally that might help it grow. Educators must lead, not reflect the community's thoughts and actions. We are being paid to do this thinking and planning for the future.

The world we face today is one of dynamic and dangerous flux. We as educators have to ask ourselves constantly, "Are we contemporary?" Are we tuned to the signals that are coming from the cutting edge of our time so that we can get the message, chart the course, and work in harmony with changes? We as educators must be aware of the dynamic forces that are changing our world, but we must also be acutely aware that we can go off in the wrong direction. We can be led into an educational trap by a sense of frustration that results in an acceptance of the thesis that since things change so rapidly, what is the use of providing educational programs for occupations? This leads me to my second myth.

Myth 2.-Technological changes are occurring so rapidly that schools should only provide the liberal arts and basic academic subjects.

This statement is heard many times and is often reflected in the pronouncements by the corporation president in his Friday night banquet

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speech. At the precise minute his ringing phrases go out over his well-dressed audience, the typesetter in the local newspaper is setting copy of the personnel director's "help wanted" advertisement. In heavy black type, the message comes through loud and clear. What can you do? We need technicians in the following fields: data processing, drafting and design, accounting, nursing, and engineering aides in manufacturing and construction. We also need tool and diemakers, setup men, patternmakers, electricians, and pipefitters.

Seldom do I see a help wanted advertisement patterned after the design as expressed by the corporation president. What are the reasons for this double talk? We might draw a parallel with the westerns on TV. The president wants to put the corporation squarely on the side of the "good guys," so he sits tall in the saddle and says, "Yup, teach them the three R's and the liberal arts." The personnel director, however, has some dirty work to get done and has to recruit some "bad guys" for his nefarious purposes out in the plant, so he talks about specialized skills and technical knowledge. Meanwhile, back on the campus, those of us who try to make sense out of these corporate smoke signals are like Sitting Bull as we say, "Ugh! Corporation man speak with forked tongue."

Occupational training is still vital, more so now than ever, due to the complexities of today's automation. The automation of today, however, compared to the mechanization and cybernetics of the next decade, would be like comparing the Model "T" to a 1966 Lincoln Continental.

Myth 3.- As vocational educators, our responsibilities end when we give the students specific skills and knowledge they need to earn a living.

I would like to quote from a guest editorial in the April 1963 issue of School Shop Magazine: "Education as a currency can be likened to a coin. One side represents general education and the other side vocational education. If the coin is split in two, it becomes counterfeit and therefore unnegotiable. Vocational education is incomplete and non-negotiable without a sound general education, and likewise general education has little meaning without vocational competencies to make it complete and make the currency negotiable and acceptable in the marketplace." This statement is still true and we had best heed.

All occupational education curricula should present a carefully balanced "mix" of general education, theory courses, and specialized courses. The determination of percentages of each by formula outside the actual college setting, however, is unrealistic and unsound. These determinations should be made by faculty committees, college administration, and trustees, and be made in terms of each program's needs and in light of the overall college policies and practices.

Myth 4.-The transfer student and the student enrolled in one of the technologies should be enrolled in the same general education classes.

This philosophy, quite widely held, usually accompanies the comment that the student might change his mind and later wish to continue his education and earn the baccalaureate degree. We do not recognize that occupationally oriented students are changing their minds with increasing frequency, sometimes at the suggestion of their employer; and oftentimes success at the associate degree level challenges the graduate to pursue the next higher goal. We certainly do not want to discourage this upward mobility, but I believe that this is not enough reason to require all occupationally oriented programs to be open-ended.

Transfer and occupational students should be combined into the same class only when the objectives of the class are the same as those needed by the occupational student and the liberal arts student. Only when these objectives match should there be sufficient reason for combining the classes.

Myth 5.-Advisory committees must be organized to assist in the planning, development, equipment selection, and program evaluation in every curriculum offered in an institution.

Advisory committees can be a tremendous asset to any institution, but certain conditions must be present or they will be a handicap to the planning and development process. The college must have sufficient administrative personnel to coordinate and work with the various committees so that their efforts will reinforce the overall objectives of the college.

The theory that advisory groups can be of great assistance in the selection of equipment must also be approached carefully. The tendency for lay members of an advisory committee to look at equipment selection from personal experience in a production capacity may color the type and amount listed for procurement.

Program evaluation is a continuous requirement, and one way to evaluate is by using a formal advisory committee. It must be remembered that the members of the committee may reflect views based upon their specific problems and needs. Often they reflect the strong views of one or two more vocal members. Such a committee can be helpful if it is used in conjunction with other sources of data.

Myth 6.-Programs should be planned and developed according to the needs of the local community.

The concept of programs based on community needs is being replaced by a recognition of the need for regional and state-wide planning. Local occupational surveys must be supplemented by and coordinated with regional and national needs as identified by surveys conducted by other groups,

such as Chambers of Commerce, planning commissions, state employment agencies, employees' associations, National Institute of Health, U. S. Department of Labor, United States Office of Education, and similar agencies.

Myth 7.-Occupationally oriented curricula in community colleges are primarily engineering related.

Since Sputnik I, "technician" has been a glamour word. It has had almost exclusively an engineering connotation. Community colleges have concentrated on programs to prepare engineering and scientific technicians for industry and research.

Other programs at the technician level but not engineering related are demanding our attention. Medicare, like Sputnik, may be the driving force behind a virtual avalanche of new programs in the health-related occupations.

The areas of service open to the community colleges are limited only by the imagination of the faculties, administration, and trustees. Of course, not all colleges can or would want to provide programs in all fields. We need to cast our eyes upon a broader horizon in the years ahead.

PROGRAMS, STUDENTS, FACULTY, AND
FACILITIES AT
NORWALK STATE TECHNICAL INSTITUTE
by
Frank Juszli*

In Connecticut, the technical institute is needed! The main objective of the State Technical Institute is the preparation of fully qualified engineering technicians prepared for immediate employment on the engineering team in Connecticut.

The State Technical Institute is the only educational unit operated by the State Department of Education, specifically organized to give full-time day courses designed to prepare engineering technicians. The part-time evening programs, which provide unit offerings, are identical with the day programs.

The two-year collegiate level curriculum offerings include the following technologies: chemical, data processing, electrical, electro-mechanical, mechanical, and tool and manufacturing.

Participation on the students' part in the day-school program requires twenty-seven hours per week in classrooms and laboratories and a considerable amount of outside preparation.

Ninety percent of the students are recent high school graduates, and 10 percent to 15 percent are graduates of vocational high schools.

Admission requirements are high school graduation or equivalency with: four units in English; two units in mathematics--one in algebra, one in geometry, or two in algebra; one unit in history; and one unit in physical science with laboratory. Since the curriculums are closely related to the fields of engineering, a good understanding of mathematics and science (physics and chemistry) is essential.

The students stand at about dead center or middle third of the high school graduation class and average about eighteen years of age; 97 percent are males and about 2 percent are from minority groups.

There are forty full-time faculty members, including four administrators and a director of student personnel. Each is required to have a Bachelor of Science degree in mathematics, engineering, or science, with three years of industrial experience. Sixty percent of the faculty are graduate engineers with no prior teaching experience but with eleven

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**Rutgers - The State University.

or more years of industrial experience.

The faculty faces classes on a basis of seventeen contact hours with students in classes where the ratio is sixteen students to each instructor.

These people are responsible for preparing graduates, a large majority of whom are annually placed in positions that support engineers and scientists in industry or the military. About 15 percent of the graduates go on to higher education.

The Institute occupies a 17-acre plot and is housed in 3 new buildings with a total area of over 100,000 square feet. Two of the buildings accommodate classrooms, laboratories, a library, and a cafeteria; the third contains a large auditorium-gymnasium. There are 16 well-equipped laboratories.

PLANNING FOR INSTRUCTIONAL RESOURCES
by
Robert B. Lorenz*

This paper is an attempt to show the requirements of a systematic application of instructional resources at a large university, a new urban university, and a job corps center. A philosophy for this systematic operation will be stated and consideration given to the requirements for staff, space, and facilities.

Facing the challenge of increasing student enrollments in American education today, school administrators have taken another look at faculty and technological resources in order to promote a quality education for all. Trends in the application of media to solve this problem have been developing in the form of mass instruction, individualized instruction, and instructional systems. The critical problem for American educators today is how innovations, personnel, and resources can be combined into a total system capable of meeting urgent national requirements. The use of technological resources and the implications of this systematic approach extend to the point of influencing learning facilities and the conventional teaching and learning patterns.

Given the objectives of more learning for more people, greater instructional effectiveness, and instructional efficiency, some educators look to the systems approach as a tool for determining effective alternatives in designing and developing a more effective educational enterprise. The systems approach pays close attention to the information network binding interacting elements of a system together. Thus, in an attempt to improve the teaching-learning process, instructional communicators are interested in making information available in a variety of forms and in a form most appropriate to the type of information and to its use, in presenting information more efficiently, i.e., more information to more people in less time with less expense and less teacher time, and in making learning effective, stimulating, realistic, and emotional. To do the job effectively, extensive support must be given to faculty members who are on the front line of the teaching effort.

One systematic approach to supplying resources and services to the faculty members at the University of Illinois is to use the Office of Instructional Resources.

> Instructional resources refers to conceptions and personnel who will implement that which undergirds a psychological analysis on structional requirements to the measurement and research services which evaluate instructional procedures,

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**University of Illinois.

to the instructional media and processes such as programmed instruction, television, motion pictures, graphics and other audio-visual aids, and to the physical settings of research and instruction.

The Office of Instructional Resources will be a service unit reponsible for planning, developing, and when appropriate, administering technological aids to instruction, and for advising and assisting faculty in using them to improve instructional effectiveness and efficiency. The Office will be responsible for keeping abreast of the developments in new programs, materials, and devices.

Organizational Structure

The conception of the Office of Instructional Resources takes the form of two groups, each having three divisions as illustrated in Figure 1.

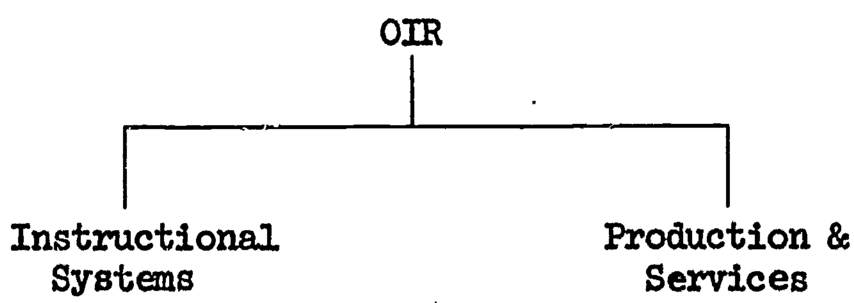

Figure 1

The Instructional Systems Group

The function of the Instructional Systems Group is to design strategies and develop techniques to apply findings from the psychology of learning to university instructional programs.

Divisions

A. Course Development Division

The Course Development Division defines course objectives, devises instructional activities, and helps to select teaching methods and media.

B. Programmed Instruction Division

The Programmed Instruction Division assists faculty in preparing programmed instruction.

C. Learning Evaluation Division

The Learning Evaluation Division assists the faculty in test scoring item analysis, test construction, and data interpretation.

The Production and Services Group

The Production and Services Group carries out instructional strategies through well-planned media production and services.

Divisions

A. Television Division

The Television Division produces and distributes programs.

B. Audio-Visual Division

The Audio-Visual Division provides information about available films, filmstrips, and audio materials.

C. Graphic Arts Division

The Graphic Arts Division contains three departments.

1. Design Department--Produces art work.

2. Construction Department--Builds sets, models, devices.

3. Photographic Department--Offers photographic services to faculty.

Service Policy

To encourage the use of these instructional resources, most services are provided without charge when used for instructional purposes. The equipment policy is consistent with the production policy, in that all major, portable, and common items of audio-visual equipment shall be purchased for and placed on the inventory of the Office of Instructional Resources. Guidelines for materials and equipment for use in higher educational institutions are available from the NEA's Department of Audio-Visual Instruction. The cost of equipment for the first phase of the development in Chicago Circle campus was $48,099.

Space Requirements

	Square Feet
Administration	2,603
Instructional Systems Group	19,378
Production and Services Group	6,370
	28,351

Staff

	FTE
Administration	2
Instructional Systems Group	6
Production and Services Group	12
	20

In order to integrate its activities successfully with the faculty, the Office of Instructional Resources was successful in identifying highly interested faculty members in local departments. These faculty members were released one-third time to identify departmental needs which might be met in significant part by the application of instructional technology. In another program designed to integrate faculty use of instructional materials, faculty members were paid full-time during the summer months and freed from teaching responsibilities to work on instructional improvement projects.

At the Champaign campus of the University of Illinois, where well-established photographic service, motion picture service, a film library, and projection operators were available to the faculty, the Office of Instructional Resources took a slightly different form. (See Figure 2.) Seeking to aid the faculty and to cooperate with existing services available, the Office of Instructional Resources in Champaign developed in the area of instructional systems groups.

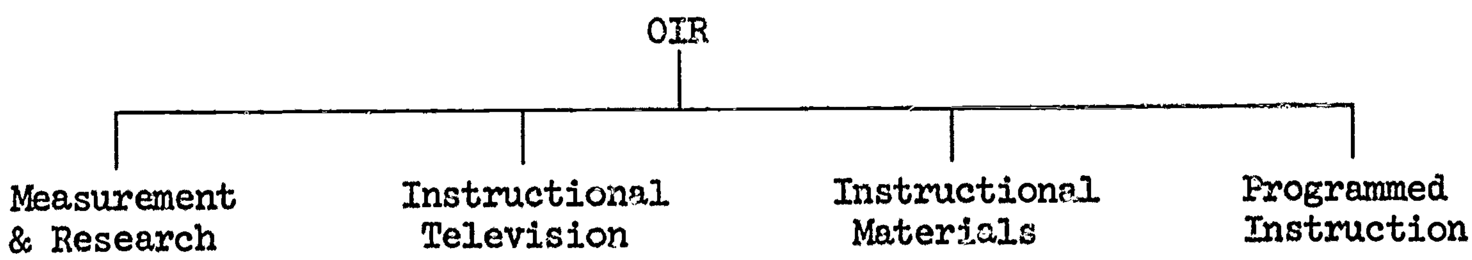

Figure 2

A proposal for a communications laboratory of the Breckinridge Job Corps Center developed along similar lines to that of the Office of Instructional Resources; however, it had, perhaps, a greater availability of funds and a more specific educational product. The differences in the two units are worthy of our attention. The goal of the Job Corps Center was to train 2,000 students.

Basic Educational Programs

	No. of Students	Hours of Training
Adult Trades Training	1,000	160
Adult Vocational Training	500	500
Adult Technical Training	500	800

A study team was assembled to consider systematically the goals of the Job Corps Center and to prescribe the necessary staff, space, and facilities. This study team recommended that major priority go to materials production facilities to stimulate the maximum use of instructional materials and to better provide materials production in excess of current demands rather than insist on full economic justification prior to acquisition. Presentation devices not likely to change were placed high on the priority schedule. Devices using relatively new materials in scarce supply were given low priority. Striving towards the goal of improving the efficiency of the learning process, the communication laboratory is seen as an organization providing a complete range of equipment and materials, production of aids and media, learning environments, automated educational systems, feedback data on student progress, and mass media communication. The communication laboratory is centrally located and is responsible for prescribing and designing learning spaces for the use of aids and media. These learning spaces will be equipped with standardized equipment, all designed for remote control from the front of the classroom. The controls for both lighting and the audio-visual equipment will be integrated into movable lecterns. Every room will be equipped with multiple screens as well as screens capable of being tilted for the overhead projector. A policy decision was made to saturate classrooms with overhead projectors since this piece of equipment requires a minimum change in habitual teaching behavior and provides an opportunity for instructors to develop a self-concept as developers of instructional materials.

Faris and Moldstad, in a nationwide survey of local production programs, cited the objectives of these programs. Local production facilities provide instructional materials not commercially available, provide materials to solve specific communication problems, and provide materials to school administrators for presenting information. All this requires space, time, equipment, and personnel. Teachers who participated in these programs not only helped to develop the instructional patterns, but also achieved, through the development of instructional materials, a better understanding of their subject as indicated in Figure 3.

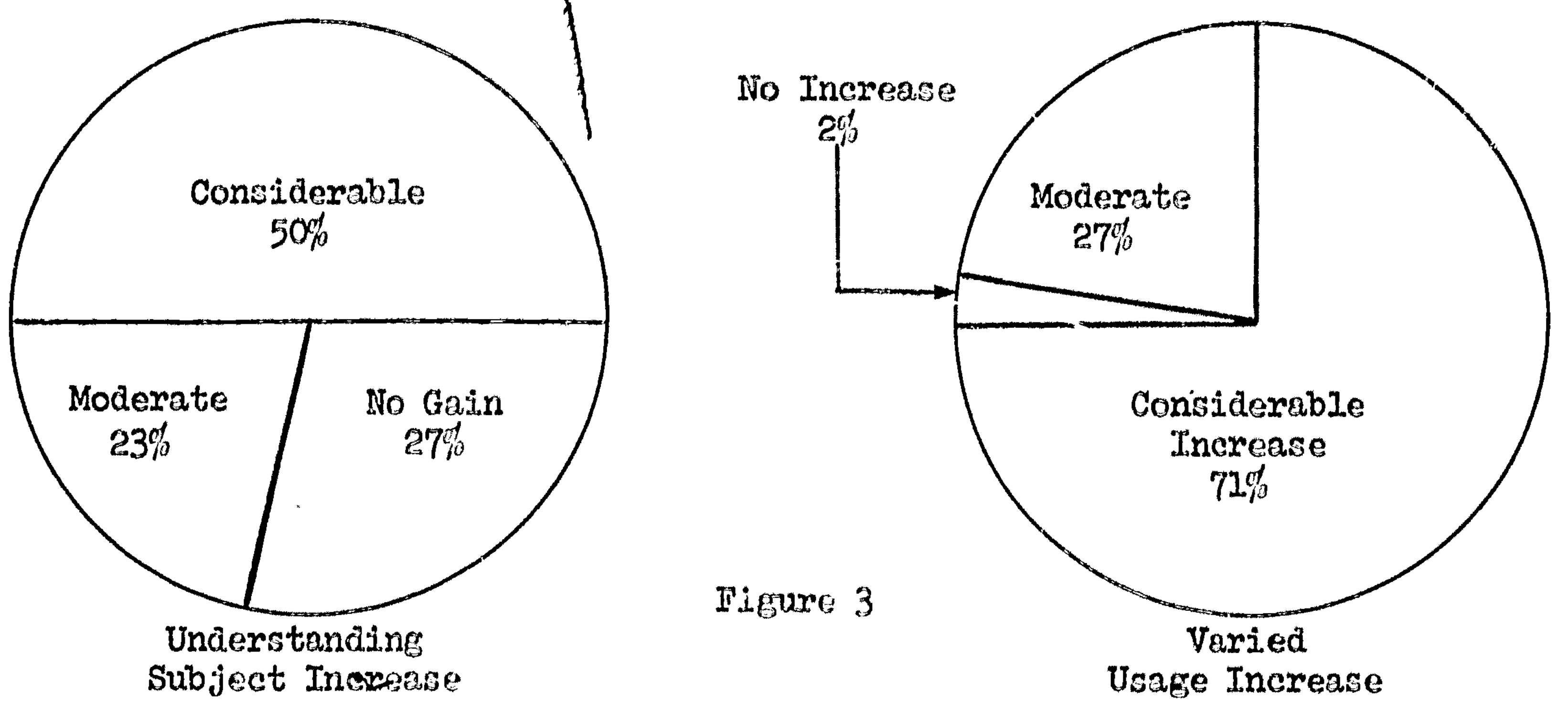

Figure 3

The production center should be able to produce instructional materials in the form of slides, graphic materials, photographs, mounted pictures, overhead transparencies, 8 mm single-concept films, audio tapes, and video tapes. Local production programs will grow only when administrators realize their value and offer substantial support to them. The goal of local production programs is to make instructional materials more accessible to instructors.

Accessibility of Instructional Materials

A TV or Radio Program	A Motion Picture	A Phonograph	A Book or Magazine Article
Low			High

The cost of equipment for both audio-visual and television equipment for the Breckinridge Job Corps Center was initially proposed at $90,000. The staff needs were seen as follows:

Administration	3
Technical	6
Production	
TV	5
Artists	3
Photographers	2
	19 Full-time Equivalents

The evidence that has been presented has been an attempt to stress the point that a systematic approach to the use of instructional resources in education can be made in a variety of educational environments. This serious undertaking cannot be accomplished without great expenditure of time, talent, energy, and money. From the experiences in three educational settings, you can see evidence of the cost in financial resources, space, and people needed to approach instructional programs systematically. Although there has not been time to evaluate the effectiveness of the communications laboratory at Breckinridge, it can be stated at this time that both Offices of Instructional Resources, one at the Chicago Circle campus and the other at the Urbana campus of the University of Illinois, are being widely used by faculties on both campuses. Keep in mind that the one goal of the Office of Instructional Resources is to improve the quality of undergraduate instruction by making available instructional resources in the right form and at the right time to faculty members.

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CONSIDERATIONS IN PLANNING AND ORGANIZING A NEW INSTITUTION OFFERING TECHNICAL EDUCATION

by

Robert L. McKee*

Area vocational schools and community colleges will carry the largest responsibility for occupational education in the United States. Occupational education in America can be best accomplished in specialized institutions, such as technical colleges and institutes, but it is more likely to be done in the comprehensive institutions.

The technical schools need to concern themselves with the teaching of much more than the technologies. In addition to the special occupation courses, a technical college should offer education courses to provide the student with the basic mathematical and scientific principles underlying the occupational objective. It should also include general education subjects in the area of the humanities which will help to develop the qualities of leadership and positive attitudes toward society. These enable the individual to become a better informed and more productive participant in society.

Technical students should devote approximately 50 percent of their time to technical education subjects, 30 percent to back-up subjects, such as mathematics and science, and 20 percent to general education courses.

Community colleges need to develop more effective methods of providing occupational programs where a special climate needs to be created for growth. To do this, the community and industry need to be solicited for adequate support to operate the quality education programs needed in our nation.

In the next ten years--as the vocational schools add academic offerings and as the two-year colleges add occupational offerings--the two will become one, and the problem in this evolution will be resolved.

Basically, there are three types of two-year colleges. First, there is the junior or academic transfer college which concentrates on the lower division of a normal four-year college program. Second, there is the technical college which concentrates on occupational programs, semi-professional programs, and terminal training for immediate employment. Third, there is the comprehensive college which is a blend or combination of the other two and is rapidly growing in popularity throughout the United States.

As the free, public, two-year community colleges to which every citizen has a right, assume an expanded role in American education, the

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universities will concern themselves more with graduate programs.

Emphasis in the community colleges should be placed on the occupational programs which lead to immediate employment because this is the path which the largest percentage of students will follow. Additionally, many citizens will continue their education in part-time evening courses and work to further their college education in the community colleges.

Staff wise, American educators need to buy their own product. Faculties need to be compensated adequately and paid to continue their education in the pursuit of professional improvement. Northern Virginia Technical College hired its entire staff on a twelve months' basis. During the summer, one-third will be teaching, one-third will be involved in curriculum development, and one-third will be on educational leave at the college's expense.

INNOVATION IN TEACHING TECHNICAL CONTENT
by
Thomas A. Strickland*

Concept formation, application of principles, and problem-solving procedures are becoming increasingly important in the preparation of technicians. How does one form a concept about what makes a substance radioactive when it may be something which cannot be seen, heard, felt, smelled, or tasted?

A concept is a psychological construct resulting from a variety of experiences (detached from the many situations giving rise to it), fixed by a word or an idea, and having functional value to the individual in his thinking and behavior. For technicians, as well as others, concepts are the materials and tools of thought processes, and are most important as products of the educational process.

Concepts are usually defined as informal or formal. Informal ones are those man forms independently, and sometimes haphazardly, as he interacts with his environment. Formal concepts are those which an educational program systematically attempts to develop. This process must be a part of technical education.

Development of broad concepts is based upon a system of concepts built upon previous experience. Consequently, progress in the development of new concepts may require some planned experiences to provide a base or bench mark from which to start. The next important step is to have the student react to the material presented. The student must participate in the process. A concept cannot be formed without experience.

To illustrate his point, Mr. Strickland distributed closed wooden boxes, approximately 3" x 8" x 12," each with some hard object inside which rolled or slid around as the box was tilted. Each participant was asked to form a concept of what was in the box and how the interior of the box was arranged. The participants attempted to describe what the object was like and what kinds of partitions were inside the box--half-length, three-quarter, full-length, with openings in the center, ends, or in between. The responses brought out the need for experiences and participation on the part of students in the formation of concepts. The boxes were sealed and could not be opened so no one really knew how correct his concepts were.

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**University of Florida.

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EDUCATION'S LEADING EDGE

by

Kimball Wiles*

People expect many things from education. From the President on down, education is seen as the tool for the creation of the Great Society.

Education has many leading edges. Included are: the explosion of knowledge, the education of the culturally disadvantaged, and automation.

At the current rate, knowledge is doubling every seven years. By the year 2000, there will be 2,000 times as many facts to be known as there are now. This explosion of knowledge is translated into an explosive expansion of technology. As technology develops, there is an ever-increasing need for technicians. These technicians require a fundamental education which will permit them to shift with the expansion of both knowledge and technology and thus remain fully effective.

The major emphasis and expenditures in American education in the recent past has been on the education of the upper half. More effort must be directed toward the education of the lower to "break the futility cycle." The only way to break the futility cycle is through education of those who are disadvantaged.

Seventy percent of the jobs in which people earned their living in 1900 are gone. Three-fourths of the workers in 1975 will be working on products that are not yet developed. They also tell us that by 1975, if automation continues at its present rate, 20 percent of the population will be unable to find work. Only 6 percent of our jobs now are filled by unskilled manual labor. We can no longer afford the luxury of an educational system that does not develop the potential of our people.

Another aspect of automation is fairly clear--the national government is no longer going to be willing for us not to have continuous vocational retraining either in school or out. The question as to whether or not it stays within the realm of public education depends upon our creative leadership in the development of educational programs to provide the industrial and technical skills which will be needed by our society.

You and I have to think about where we stand and whether what we are doing is enough to keep the directive approach from the outside from being necessary. I think that as you deliberate in this conference, you are not dealing with technical education alone--you are dealing with the cutting edges of America. You are helping to decide the society that we will have, and you are deciding what people with your range of problems, with your vision, with your knowledge and skills, and with your opportunity can do to make technical education available to more people and make it more effective.

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EFFECTIVE GUIDANCE ACTIVITIES AND PROGRAMS FOR TECHNICAL EDUCATION

by
J. Henry Zanzalari*

There are many definitions of guidance--as many as there are people to write them.

The United States Office of Education suggests:

> Guidance is defined as the process of acquainting the individual with various ways in which he may discover and use his natural endowment, in addition to special training available from any source, so that he may live and make a living, to the best advantage to himself and to society.

Robert Mathewson views guidance as:

> .....the systematic, professional process of aiding individuals in making their choices, plans and adjustments; in understanding effective self-direction, and in meeting those problems of personal living that fall within the sphere of educational responsibility.

Arthur Traxler claims:

> Guidance implies first of all recognition and understanding of the individual and creation of conditions that will enable each individual to develop his fullest capacities and ultimately to achieve the maximum possible self-guidance and security.....

Edna Baxter succinctly notes that:

> Guidance is intended to help the child to help himself.

Guidance can be categorized and viewed from different vantage points and discussed in terms of vocational guidance, educational guidance, recreational guidance, health guidance, civic guidance, moral guidance, and social guidance.

Some techniques in the administration of guidance might be through the pseudo-sciences: astrology, phrenology, physiognomy, graphology, and numerology. However, it is recommended that guidance personnel use the

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techniques inherent in the following: testing, counseling, using occupational information, placing, and following-up on graduates.

The employment of these techniques is necessary to reach the objective of guidance services--the fulfillment of the individual. In a vocational guidance setting, the process involves understanding of self, the world of work, and the relationship of one to the other. The natural result is logical decisions.

It is important to know how a student examines himself, his interest patterns, his personality, his educational abilities, and his physical characteristics.

It is suggested that student interest patterns can be evaluated by examining: work performed with machines and tools; work with numbers; work with new facts and new problems; associations with people, promotion of new products or ideas; involvement in artistic and creative work; abilities at reading, writing, and acting; enjoyment of music; concerns for people; likes or dislikes for statistics; and work performed outdoors.

Personality patterns can be evaluated on the basis of whether a student likes: to work with ideas, to be active in groups, to avoid conflicts, to direct others, to be in familiar or stable situations, to work fast, and to do things others can't do.

Mental abilities can be evaluated in relationship to: verbal comprehension, reasoning, number and spatial abilities, and mechanical comprehension.

Evaluation of self is accomplished through a series of occupations where one learns: the workers' duties, qualifications, and preparatory needs; methods of entering the job; and its conditions, earnings, and its promotional opportunities.

At this point, the comparative method of occupational selection takes place--resulting, hopefully, in wise decisions.

The Middlesex County (New Jersey) Vocational and Technical High Schools utilize these suggestions through: recruitment and promotion; selection based on cumulative records, past performance, entrance testing, and interviews; in-school guidance including testing and counseling; and post-school guidance, i.e., the placement and follow-up of students.

Experiences in selecting students have netted these observations:

1. Overage and retarded are likely to be inferior in aptitude and represent a poor educational risk.

2. Personalities are difficult to determine.

3. There should be physical examinations, expecially where there is evidence of a disability.

4. Student records are significant in predicting future grades.

5. Number of days in attendance previous to enrollment correlates highly with subsequent educational attainment.

6. Intelligence is an important factor in vocational courses, especially where the interpretation of written instruction is a factor.

7. The average Intelligence Quotient is 100.

8. Fifty percent of the students come from families with trade backgrounds.

9. Seventy-five percent of the students have never failed a grade and are at the correct age for the grade.

10. Students tend to have part-time jobs throughout their educational careers.

11. Students have strong interest patterns.

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PART VI

FACILITIES AND EQUIPMENT FOR TECHNICAL EDUCATION

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FACILITIES PLANNING

by

George Mehallis*
and
Donald C. Bulat*

This presentation covers both campus development and the science and technology facility at Miami-Dade Junior College. A discussion of planning and development of the South Campus is presented first, followed by a discussion of the science and technology facility on the North Campus.

Planning and development of the South Campus was based upon a series of requirements which were prepared as guides. Each requirement will be stated, followed by a discussion of the considerations involved in planning and development.

Requirement: To place junior college facilities within reach of the people of a wide-spread metropolis

The site was selected by a team of men who had already worked together on the development planning of the North Campus, comprised of the Advisory Committee of the Junior College, staff members of the Junior College, staff members of the Dade County Board of Public Education, and Board and project architects. Through reference to the County's General Land Use Master Plan, the site selection team was able to select a site which would ultimately lie near the intersection of south and west expressways. These expressways will provide easy accessibility to any area that extensive network touches, including the existing North Campus and the future downtown campus. The three campuses, to be connected by tower-to-tower communication beams, are planned to be the basic components of a system of facilities which will grow more complex with the county's future needs. The entire system will be directed from administrative offices on the South Campus.

Requirement: To define educational goals, to formulate and describe learning processes, and to produce a guide for planning and design

The staff of Miami-Dade initiated a process in which department heads discussed basic requirements with their faculties in the first of a series of meetings; their second meetings explored imaginative teaching theories; and the third collected positive and negative reactions by the faculty to other facilities it toured. While this process

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**University of Florida.

was, in and of itself, of great worth to those involved, the resultant educational specifications were invaluable to the planners and designers of the South Campus.

Requirement: To arrange and proportion the workings and amenities of a site to make it a unique, complete, and beautiful place

The South Campus plan, in Phase I, has provided for the daily accommodation of 3,000 automobiles at any given time. The majority of these are student cars which circulate on a four-lane perimeter road. A smaller inner loop road is restricted to service vehicles and faculty cars. The larger parking areas are landscaped to reduce their apparent size. The occupant of any parked car has no more than a five minute's walk from a building.

Much like a small city, the core of structures has been centrally placed on the site; and although it is not precisely a walled city, it is into the core buildings and plazas that pedestrians can escape the world of the automobile.

Lakes have been placed to formalize the main entrance. The excavated fill is employed to raise the central core and the parking areas above flood levels, and the lakes serve as catch basins for positive underground drainage of the entire site. Other utility systems are less extended, taking advantage of the tightly grouped core and the centrally placed utilities building.

Within the core are two plazas defined by building masses and covered walks. The entry plaza will be completed with the three buildings of the first construction phase. It will receive the action of the main entrance and, with oak trees and permanent sitting wells, will play a more formal role than the larger, lower-level, academic plaza which will receive the main focus of student attention.

Requirement: To make several thousand coordinated decisions, creating both buildings and spaces which belong to their time, place, and purpose

Planning and architecture share so many of the same processes that it is merely a convenience to discuss them separately.

The buildings are individual but strongly unified by their geometric masses and the use of exposed concrete and precast paneled walls. Generous roof overhangs produce pronounced shades and shadows. Although the buildings are solid elements, open space runs into and through them. Their effect is simple but not plain.

Educational specifications notwithstanding, it is certain that future use of interior spaces will change. Even between phases of development,

use rearrangements will occur. Long-span construction permits partition relocation. Although low partitions subdivide areas such as teaching offices, removable or folding partitions have been called for only where there is a certainty of frequent use. The most flexible feature of the campus is its large variety of facility sizes and types.

Requirement: To have determined leadership and to secure the active cooperation of people and organizations

All persons and agencies who have an interest in the college and/or a contribution to make should be called upon.

The science and technology facility was a major academic building provided in the master plan of the college. The planning sequence followed the pattern outlined earlier, involving the faculty to the maximum extent.

The new science and technology facility, designed for instruction in a variety of technological subjects, contains twenty-two large laboratory-workshop-drafting room combinations, eighteen adjoining classrooms, a unique teaching-conference room, and ninety offices for the teaching and administrative staffs. The offices have been grouped together in such a way that facilities may be shared by those having similar interests and are in close proximity to classrooms and laboratories.

Laboratories constitute the main mass of the building and surround a central classroom block. Corridor walls are built with precast framed windows which permit viewing of the laboratory spaces. Each module of laboratory space, and each classroom is supplied with individually controlled air conditioning.

Mechanical services are supplied from the perimeter of the building, and exhaust vents are situated unobtrusively in column recesses.

Laboratories for mortuary science instruction are in an adjoining, but completely separated, building to the west of the main structure in order to provide for special requirements in air conditioning and privacy.

FACILITIES FOR TECHNICAL TRAINING PROGRAMS

by
Alexander Ducat*

Vocational educators have long been leaders in the philosophy that one learns by doing. While this philosophy that one learns through activity and that one learns with every cell of his body is applicable to any learning situation, the methods and means of doing it will differ, dependent on the subject matter.

Technical education, which is largely concerned with knowledge rather than with manipulative skills, will differ in its requirement of apparatus from other vocational programs. It will use equipment to reinforce, through activity, the learning of theory. Technical programs have equipment, particularly of the type used in industry, to confirm scientific principles by experimentation and to familiarize the student with industrial applications. Such equipment speeds learning by aiding in the solution of problems and by illustrating the principle of its application.

The task of training technicians require the use of classrooms, drafting rooms, and laboratories. There is also some need for shops, such as those used for skilled crafts training which are equipped largely for the development of manipulative and tool skills. However, in the technical education program, the shops serve, not to develop manipulative skills, but to develop understanding of the materials and processes commonly used in the technology.

The Laboratory and Its Function in Technical Education

The laboratory is the "proving ground" in the technical education program. Here the student utilizes his mathematical tools and confirms the theory of the science classroom.

Laboratory equipment may be divided into two types. Some equipment is used to illustrate a scientific principle; other equipment is used to illustrate an application. In some cases, this line of demarcation is not too clear, and, of course, any application will use a scientific principle.

Educational objectives attained through the effective use of laboratory training include the following:

1. Securing functioning understanding of principles of science,

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**Oklahoma State University.

e.g., phase shift control in electronic tubes or stress-strain relationships in tension testing.

2. Learning the properties and processing of materials, e.g., properties of semi-conductors or the welding of alloy steels used in connection with nuclear reactors.

3. Learning the construction and operating principles of industrial equipment, e.g., mechanisms used in a process control instrument or the functioning of a rotary converter.

4. Developing ability to diagnose troubles in equipment, e.g., locating malfunctioning in a tape-controlled machine tool or in a radar unit.

5. Developing skill in utilizing technical principles in performing other types of technical tasks, e.g., precision measurement of intricate products or in testing of newly developed equipment.

In summary, the function of the laboratory in technical education should enable the student to:

1. Acquire a functioning understanding of scientific principles.

2. Confirm scientific principles by experimentation.

3. Become familiar with industrial applications.

4. Become competent in the use of laboratory equipment, precision measuring and computing devices, and scientific and engineering handbooks.

5. Acquire knowledge of the tools of industry.

6. Correlate the specialized technical courses with mathematics and science.

7. Develop to his maximum capacity.

Laboratory Management--Selection and Use of Equipment

To achieve the objectives indicated through laboratory work requires a considerable variety of equipment carefully chosen to meet specific educational objectives. For achieving understanding of basic principles of science in the electrical field, the equipment needed would include meters, switches, electrical machines, control devices, resistors, capacitors, transformers, and many other items. For such an objective in the mechanical field, special equipment would be required which demonstrates the use of simple machines, such as levers, gears and cams, or

principles of hydraulic or pneumatic pressures.

Laboratory equipment for studying properties of materials would include such items as heat treatment furnaces, tensile and compression testing machines, and hardness testers. Materials processing methods would be learned through selected metal working tools of toolroom and production types, and similar machines, if needed, for other materials than metal.

For the study of construction of industrial equipment and of operating principles of such equipment, typical machines and instruments would be needed. In some cases, cutaway units might be used; in other cases, units capable of operation would be needed. For trouble diagnosis training, the equipment needs are largely instruments and their accessories, together with the equipment on which the trouble is to be located.

The range of laboratory equipment needed for technician training programs is great, and the cost of such equipment can become a sizeable item in the capital outlay budget. It is, therefore, essential that much care be taken in determining just what equipment is needed to meet the demands of the program. Since each item of laboratory equipment serves one or more specific purposes in the training program, these purposes must be listed if the task of equipment selection is to be done well. The best approach is to prepare a detailed outline of each instructional unit in each course in the curriculum. Preferably, the instructional units should be worked out by the course instructor. For each unit, he would designate the equipment needed by each student performing the laboratory assignment. In some cases, it is not possible to have the instructor make up the equipment list, and the task will need to be done by the head of the department or some other person who is familiar with the details of the instructional units of the course and the way in which they will be taught.

The quantity needed of each item of equipment will be influenced by such factors as the following:

1. The extent to which the item is used in more than one instructional unit in the course, or in other courses.

2. The number of students in the class.

3. The sequence and difficulty level of the instructional units in the course.

If each student had to start with instructional unit No. 1 in the course and continue in consecutive order through all the units, the quantity of equipment needed for this unit would be that required for a single student multiplied by the number of students in the class. That required for subsequent units would be determined in similar manner, taking into account items of equipment that were used in previous units.

Ordinarily, however, it is possible to group together certain instructional units which do not depend upon each other in the sequence of learning, and which are of approximately equal difficulty, and spread the class group among these units. This cuts down on the needed total equipment which is peculiar to specific units.

In some types of laboratory assignment, it is permissible or preferable for students to work in small groups. In such cases, the equipment needs are cut in accordance with the group size.

It cannot be emphasized too strongly that equipment should be used with a clearly defined objective, that knowledge acquired through its use should be psychologically timed in the course of study, that the student should have a concept of what it is about before he uses the equipment, and that he should be forced to summarize his conclusions after its use. All this involves considerable work by the instructor. He must choose the spot where equipment will make for more efficient learning. He must pick the equipment so that it will be effective and not confusing. He must furnish proper instructions in the use and limitations of the equipment, including possible incorrect usages. Finally, he must check the student after the equipment has been used to ascertain if learning has been accomplished.

The technician must be trained in the scientific method. He must not only understand how things work; he must be able to analyze the unknown. This does not mean that he is trained as a research scientist, but he must be able to solve problems. He must be trained to work with applications that have not as yet been invented. He must be taught to analyze.

To be able to analyze, the technician must be well-grounded in science and mathematics and have practice in problem solving. Some questions have been raised about the value of laboratory experiments. For example, it is standard practice for an individual to go through the common experimental setups as usually found in laboratory courses, and it is postulated that such experience will give the technician familiarity with problems of the type which he will encounter on the job. However, the Navy has found that this type of experience does not help much when the individual comes face to face with an actual breakdown of equipment. Why is it that laboratory learning does not transfer over to the real working world? It could be that quite a bit of research is needed in order to understand how to balance course content between the general and the specific.

It is clear that simple manual competence at a technical task cannot be expected to fulfill the needs of the current technical society. Industry requires technicians who are capable, not only of grasping concepts, but also who have the ability to take given concepts and extrapolate in a creative manner. Consider the high-reliability design philosophy which states the idea that there are two types of technical

failures which can occur in working systems. The first is a catastrophic failure, in which case, the entire system ceases operation, and the second is a functional failure caused by a system operating below its rated efficiency. The latter case creates an extremely elusive problem for the technician; and without first-rate training in technical problem-solving, today's technician is at a great disadvantage. There is no doubt that if realistic problem-solving were considered a distinct entity, equal in importance to the exposition of factual data in the technical program, we would have a product much more valuable to industry.

More emphasis on problem-solving would, of course, have some bearing on equipment requirements for technical education.

In design courses, the student is working with parts involving sizes and specifications based on empirical laws which have scientific bases. How can one design with understanding, a riveted joint, if he has not torn apart such a joint nor studied the action of metal under shear in a strength of materials laboratory? How can a designer specify with understanding carburization of a part unless he has looked at the cross-section of such a part under the microscope in a metallurgy laboratory? How much greater the understanding if he himself hardened the part, prepared the specimen, and photomicrographed it himself!

Some apparatus may be needed as samples. It is surprising to find the number of drafting rooms where parts are being drawn with no samples of the part or any concept as to the use of the part. Every good drafting room has a "bone-yard" where all kinds of parts are accumulated. These should be used by students to help them understand assembly and detailing and the use of auxiliary views. They should be used for the design of parts that fit and function with these parts. They should be used as examples of manufacturing methods and pieces for which jigs, fixtures, and dies may be designed.

In discussing the drafting room we should mention that the facilities should duplicate those used in industry. If the industry used drafting machines, and they all do, then the school drafting room should include drafting machines. The table should be the type and the boards the size that are used in industry.

All of the supplies, the instruments, the scales and the paper should meet industrial standards. Where possible, the procedures should be those used in industry. Reproducing equipment should be large and modern. The checking should be carried out as it is in industry.

Beside this conformation to industrial practice, the drafting room will need other training aids. There should be a file of industrial prints, a reference library, a large bulletin board where samples of good work may be posted, a blackboard, storage cabinets for parts and supplies, and an overhead projector for visual aids.

The same philosophy applies to electronic laboratories. The equipment with different sources of power must be readily available. There must be storage facilities with provisions for students to keep complicated wiring circuits set up for the next period if they have not finished their investigation.

The apparatus should be diversified. Several makes of the same type of apparatus should be included, not only the apparatus which pertains to electronics but also the electronic apparatus that is used for other purposes. The stroboscope and vibration meters are examples of such applications.

The recitation area for electronics should have a demonstration table with facilities for obtaining all types of power and facilities for visual aids such as blackboards and screens. The preparation room adjacent to this demonstration room should contain apparatus for demonstrating scientific principles and applications. Provision should be made that if quantitative demonstrations are to be made the results will be visible to the class.

All of what has been said so far is ideal and will be temporized by the demands of a given situation. Equipment--plenty of equipment--is essential to technician training. Ideally, every scientific principle would be backed up with scientific apparatus to demonstrate the principle and the applications. This may not be economically feasible because of the limitations in time, in the curriculum, and the budget. The local director of the training program must have a philosophy of choice based on the learning potential, balance in the program, and the cost.

The director, with the teacher involved, must decide whether the apparatus is for teacher use or for student use. Roughly speaking, demonstration equipment should be durable. In the early stages of the course, it may be necessary to have the same equipment available for all the students at the same time. In later stages, it may suffice to have one or two pieces of the same apparatus and rotate the pupils. This would be particularly so for expensive equipment.

If kits are included in a course, it means they would have to be purchased each year since they would be part of the course of study. We are talking now of the type of kit where the unassembled parts of a finished instrument or device are furnished, such as a power supply kit or a resistance-capacitance bridge kit. One would question where all these finished kits were going to be used. If not in the course of study, they should be constructed during after school hours.

This is no reflection upon the quality of such kits or the utility of the learning which may be accomplished in building them. They are expensive if they must be purchased each year. They are time consuming in an electronic technician course. It is to be hoped that the students will purchase kits and complete them on their own time.

Much can be learned by assembling kits, but some teachers in their effort to make the equipment dollar go farther, have misinterpreted their purpose. The same may be said for other equipment about the laboratory, such as breadboards and benches which teachers construct. Such items can be purchased quite reasonably, and a teacher's duties are so time consuming as it is, that any time spent on such work must surely be taken from work necessary to the course.

The same attitude must be taken toward equipment which is donated or which is acquired from surplus. Many a teacher has built up a course about some equipment acquired in such a manner which does not meet the objective of the course, or has spent valuable time altering equipment for use in the course.

In short, the selection and use of equipment for the technical laboratory should be made to permit maximum training in a minimum of time with consideration being given to the following guide lines.

1. Laboratory equipment should support a planned program.

2. Theory classes and laboratory experiences should be closely correlated and preferably taught by the same instructor.

3. Laboratory manuals should be used to supplement and expand detailed course outlines and other teaching materials.

4. Laboratory time should not be used for theory lectures or discussions. (Equipment used in directed applications to confirm and reinforce theory.)

5. Strict discipline of laboratory time is necessary

   (a) Laboratory periods should provide sufficient time to complete assignments.

   (b) Instructor-pupil ratio should be carefully controlled.

   (c) Laboratory sessions should be planned and organized so that a minimum of time is spent in setting up apparatus.

   (d) Laboratory experiments should be designed on an effective time schedule. (sufficient time.)

6. A maximum of twenty students in a laboratory section is desirable.

7. Laboratory exercises and materials should be constantly revised and upgraded.

8. Laboratory experiences should be included at the start of the technical program.

9. Staff members should be allowed planning time for developing and testing laboratory exercises and equipment.

    (a) Summer periods could be utilized for planning.

    (b) Individual released time could be used.

Design Considerations and Costs

The equipment must be chosen for its level of learning. Its place in the course and how it will be used must be well understood. It should not be purchased on the basis that, "It would be nice to have." It must match the objectives of the course. In fact, the equipment list should grow out of the course of study and not the other way around.

Equipment should be purchased with a view toward keeping the curriculum in balance. Are there courses that are weak in apparatus? Are there some fundamentals wherein presentation could be improved by the use of equipment? Might some subject matter be covered more rapidly through the use of good demonstration equipment? Will some equipment lend itself to dual application, that is, might it possibly be used in two or more courses? Is the size and model under consideration appropriate for the intended purpose? Where there is a choice between demonstration and pupil exercise, between expensive and cheap equipment, which choice will bring the greater learning?

Cost is always an important consideration. It might be wise for the director to divide his prospective purchase list of equipment into categories such as a "must list" and "desirable list" and a "nice to have list." In each case, the decision to purchase should be based on the learning that is to be accomplished and the cost per pupil.

In planning of programs, the technical educator should:

1. Plan the instructional program--that is, determine the areas of technology that are to be offered.

2. Make a survey of existing institutions and industry as well as the service area.

3. Determine how many students will be admitted to the program.

    (a) Class size of forty students and laboratory sections of twenty students.

    (b) Area in square feet varies from 40 to 170 square feet per student, depending on the type of program.

4. Determine how many teachers will be needed.

5. Plan layout of shops and laboratories and include drawings and equipment lists.

6. Specify and purchase equipment.

   (a) Good equipment is essential.

   (b) Equipment must be accurate and well designed and should be the type used in industry.

   (c) Sources of equipment other than direct purchase should be considered.

      (1) Lease-purchase

      (2) Rental

      (3) Government surplus (brochure)

      (4) National Industrial Equipment Reserve (address)

7. Employ architect to design building around layout.

8. Building for technical programs should be designed for flexibility.

9. There is a felt need for construction standards for technical education facilities.

10. A resource center at the national level would be of value to planners of technical education facilities.

11. Cost of technical education programs

    $4000 - $5000 per student for buildings and equipment
    $1000 - $1200/student/ year for operation

FACILITIES AND EQUIPMENT FOR TECHNICAL EDUCATION

by
Lucian Lombardi*

In the state of Connecticut, the technical institutes are distinct and separate from the community college. The technical institutes are state supported, financed, and equipped. The state is the only sponsor.

Prior to establishing, building, and equipping an institute, and the initiating of an educational and training program in an area, it is necessary to conduct a survey of students, labor, and industry to determine the number and kinds of job opportunities and the number of students available and interested in the technical education program. The survey can be accomplished by polling the school superintendents of an area to determine needs and by using student-labor management questionnaires to determine interest and training needs.

An advisory committee should be formed, consisting of twenty to twenty-five members to determine the size and cost of the school, the nature of the technical offerings, the curriculum, the size of classes, and the site of the school. The advisory committee should be divided into three sub-committees: legislative, site, and curriculum. The legislative committee appears before the legislature to acquire the funds to do the job.

In the selection of a site, the site committee aids in the selection and procuring of a location and uses the following criteria. The site must: (1) be central to area surveyed; (2) be large enough for parking, athletic activities, and future expansion; (3) have or be able to add the facilities necessary for water, gas, and sewerage; (4) meet zoning regulations; (5) have a favorable environment for an educational institution; and (6) stand up to construction standards determined by test borings.

Planning the development of the site requires the advice of architects, mechanical engineers, and landscape designers. Each should be selected on the basis of experience, and each must be thoroughly familiar with state and local building codes and safety requirements.

In determining space requirements for the laboratories and classrooms, it is helpful to utilize the advice and aid of the experiences of the faculty, the experiences of other schools, the United States Office of Education, the professional associations, equipment suppliers, graphic standards, and visits to other schools.

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**Rutgers - The State University.

The building should include: administrative offices; cafeteria(s); custodian storage; corridors, including elevators, lockers, and stairs; delivery doors; equipment storage; evening school facilities; faculty offices; guidance suites; library; student lounge and student union; and a ventilating and operating unit.

During the construction period, it is important to determine the equipment and service requirements, to locate ironwork, columns, and small spaces; and it is important to work closely with the architect, mechanical engineers, and the contractors.

Plan ahead for audio-visual rooms, clocks, closed-circuit television, public address systems, team teaching, and the utilization of audio-visual aids. Heavy equipment ought to be on the reinforced first floor.

When determining equipment needs, anticipate and list everything in the area of equipment, small and large tools, and supplies. Establish priorities and refer to catalogs, equipment and supply description lists. Determine special requirements and make estimate of costs. Consider, also, maintenance and office equipment.

In the selection of equipment, it is necessary to select up-to-date equipment that is moveable and allows for flexibility.

A building superintendent ought to be appointed early in the construction period so that he may become thoroughly familiar with the building. The director of the institute ought to be appointed early to oversee the total operation relative to construction, delivery, and staffing.

FACILITIES PLANNING,
CONSTRUCTION AND FINANCING
by
Ellis Rowland*

Site selection is one of the most important aspects of planning for a new campus, since it will determine for many years hence the character and nature of the educational opportunities afforded the youth and adults of an area. The most judicial decision is one based on sound criteria and consultation with architects, landscape architects, and engineers.

The establishment of a checklist to be used as a guide for selecting sites for community colleges is difficult and risky, but the use of this rating provides a reasonably objective device for ranking sites under consideration. The list ought to be divided into six major sections of varying importance: size of site, site characteristics, costs, accessibility, environment, and integration with regional planning.

The most important criterion is the availability of at least 100 usable acres. Two hundred or more are preferable in most cases.

The site should be in one piece and unencumbered by existing or future easements or public rights of way. A rectangular shaped parcel is preferred over long, narrow sites to permit the best development of the academic area and maximum accessibility from the perimeter. Sites with steep slopes and irregular topography should be carefully evaluated. The central campus area should be relatively flat for economical construction. All the land need not be flat. Sub-soil conditions should be examined to insure a minimum of rock, quicksand, and sub-surface water conditions.

Site costs should include the original price, development, including demolition and utilities, and additional building costs incidental to site conditions.

Site selection should be done with deliberation and not influenced by a capital gift which may impede future expansion and have high development and building costs incidental to utilities and site conditions.

The college should be located for the easy and close accessibility for the greatest number of students, since studies show that the majority of students and faculty--day and evening--arrive by private car pools. In comparing sites to best serve all populated areas, a factor should be developed by multiplying the number of students from each area by the

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**Rutgers - The State University.

distance to be traveled, and by the time it takes to travel the distance to each of the suggested sites.

The site should provide safe and healthful conditions and should be relatively free from the sources of noise and danger. The site should also avoid the extremes of cold, excessive winds, smog, fog, and offensive odors. The surroundings should tend to create a feeling of pride and respect for the college.

The site must be acceptable in the regional plan of the locality, must not interfere with other regional projects, and must be of value for extensive use by all citizens of the region as a cultural center. It should be located for the convenience of the greatest number of students and not for what it will do for a segment of the community.

Another important aspect in planning is the development of long-range enrollment projections and the breakdown of total enrollments into major programs. Space facilities should be projected on "Space Utilization" and "Space Projections" to convert curricula to space. Building Requirements Programs giving areas and functions of each space in the building should be prepared.

In New York, the appropriate personnel of each community college are required to follow this prescribed procedure:

1. Develop long-range enrollment projections by curriculum for freshmen and returning students in regular full-time curriculum programs and special programs.

2. Complete facility projections to 1970.

3. Prepare and submit building requirements, visit sites, and appraise land.

4. Select architects--contracts drawn must be submitted to the State Director of Community College Facilities Planning for approval.

5. Have site plans approved by State University.

6. Itemize estimated costs (done by the architects) of construction, electrical, plumbing, mechanical trades, utilities, site improvements, roads and landscaping, and architectural and engineering services.

7. Include sponsor's contribution toward the construction project.

8. Submit preliminary and working drawings to the State Director of Community College Facilities Planning for approval.

9. Submit request for the total construction budget to the Executive Dean for approval.

10. Submit copies to the State Director of Community College Facilities Planning at the time the bidding is announced to the public.

TABLE #1

TYPICAL PLANNING BUDGET ESTIMATE

1.	Total Net Area from Program			65,760 Square Feet (SF)
2.	Factor of Increase (Gross/Net Ratio)			
	Function Distribution	Net Area	Gross Area	
	a. Administrative Bldg.	25,410 SF @ 150%	38,115 SF	
	b. Classroom Bldg.	19,680 SF @ 150%	29,520 SF	
	c. Science Laboratory Bldg.	20,670 SF @ 167%	34,519 SF	
	d. Average Factor of Increase		155%	
3.	Total Gross Area		102,154 SF	
4.	Building Base Cost Per SF			
	a. Administrative Bldg.	38,115 SF @ $19.66		$ 749,341
	b. Classroom Bldg.	29,520 SF @ 21.41		633,023
	c. Science Laboratory Bldg.	34,519 SF @ 26.31		908,194
	d. Average Base Cost per SF	22.45		
5.	Total Base Cost			$ 2,290,558
6.	Additive Items	Applicable Cost Gross Area		
	a. Air Conditioning	25,410 SF @ $3.02		$ 76,738
	b. Elevators	72,634 SF @ .63		45,759
7.	Location Factor	0.94%		$ 22,582
8.	Time Adjustment	2 years @ 3.5%		$ 168,913
9.	Total Building Estimate			$ 2,581,968
10.	Total Building Estimate per SF	$25.31		
11.	Site Improvements @ 10% (Site Improvement for Total Campus 12%) (Utilities for Total Campus 8%)			$ 258,196
12.	Total Construction Budget Estimate			$ 2,839,164
13.	Planning, Supervision & Administration @ 8%			$ 227,132
14.	Equipment Cost			
	a. Administrative Bldg.	18% of $749,341 - $134,881		
	b. Classroom Bldg.	23% of $632,023 - $145,365		
	c. Science Laboratory Bldg.	35% of $908,184 - $317,865		
				$ 598,111
15.	Total Project Cost			$ 3,664,407

TABLE #2

COST GUIDES FOR COMMUNITY COLLEGES

	Factor Net to Gross Area	Cost* per Sq. Ft.	Cost of Air Conditioning per Square Foot	Equipment Cost %
Administration Building	1.5	$24.31**	$3.02	18
Industrial and Technical Building	1.6	23.61	1.70	35
Classroom Building	1.5	21.41	3.02	23
Lecture Center	1.67	24.50**	3.10	
Fine Arts Classroom	1.67	25.00	3.02	30
Faculty Offices	1.5	20.00	3.02	18
Auditorium	1.26	30.00**	3.10	18
Library	1.32	24.32**	1.71	25
Gymnasium	1.42	23.50	2.96	12
Science Laboratory & Classroom Bldg.	1.64	26.31	2.58	35
Student Center Building	1.70	26.90	2.06	30
Service Building	1.33	15.00	--	20

* To be multiplied by location factor for various campuses
** Includes normal air conditioning

Multiply above costs by 3.5% to get labor and material escalation per year.

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PART VII

STAFFING TECHNICAL EDUCATION PROGRAMS

STAFFING THE TECHNICAL PROGRAM

by
William L. Bolin*

There are several considerations which bear discussion before one is ready to staff his technical program. These include:

1. The relation of the philosophy and objectives of the institution to technical education.

2. The administrative structure and attitude toward technical education.

3. The position of technical education within the institution and among institutions and society.

4. Requirements for an "ideal" staff member.

As soon as the administrator has satisfied himself on these issues, he is ready to locate staff members who fit into the position the institution has taken.

There are some general considerations pertinent to selection of the technical staff, regardless of the philosophical base from which one is operating. First, it is desirable, nay necessary, that the occupational instructor have practical or work experience in his specialty. In order to teach effectively the subject matter consistent with the objective of employment, the instructor must be aware of the conditions which exist on the job. Could a nursing instructor effectively teach nursing students for employment in a hospital if she had never been in a hospital? It is universally recognized that experience in industry is an essential qualification for good technical instruction.

The instructor should be capable of teaching across subject lines. The scientific disciplines are interrelated and use mathematics as a common language. The effective instructor must be versed in the disciplines related to his own specialty, as well as in mathematics and other communications media.

The technical instructor must keep up-to-date in his field. The expansion of technology is rapid, and it is anticipated that this expansion will continue at an almost exponential rate. The teacher cannot afford to turn out a graduate who is filled with obsolete knowledge.

The specific educational qualifications of the faculty are related to the type of institution and accreditation standards. These

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**University of Florida.

educational requirements are frequently administered through certification by state departments of education. The general specifications include subject matter and supporting courses in excess of the level for which the program is designed. Work experience may be used to offset formal education in some cases.

Faculty loads are particularly important in determining the required staffing level. Care must be taken to insure that work loads are evenly distributed and that faculty has adequate time to prepare and study to keep abreast with developments in their respective fields.

A qualified staff of adequate size is essential to effective programs of education. In this age of technological emphasis, a highly motivated, well-prepared and current, versatile staff is imperative for successful technical programs.

STAFFING
by
Jerry Dobrovolny*

It is a pleasure to talk with all of you. I believe these kinds of meetings, conferences, and institutes have, in the last few years, brought about more understanding of technical education than has anything else. It is most important for people to communicate and keep in touch about developments.

Training teachers in technical education is not quite as serious in Oklahoma, but it is a situation that needs our attention. In 1958, we began in our state to think in terms of implementing Title VIII of the National Defense Education Act of 1958. Of course, as you know, there are many ways the NDEA 1958 Title VIII was interpreted in various states. It was somewhat happenstance that I became involved in it. I have had an interest in technical education since about 1952, but in 1958, I came in contact with the newly-appointed director of technical education. We had many things in common. We interpreted the law to mean training high-level engineering type technicians under Title VIII, and we developed a rapport between our College of Engineering, our College of Education, and our State Board in Springfield. We started discussing high-level programs of engineering technologies. The Act was restricted to the engineering-related type of activity. Of course, it has broadened now, but the same holds true in the other subject areas. We found very quickly that in order to have these so-called high-level programs, it would be necessary to have competent staff.

It was also decided at that point that the University, as such, would not enter into any two-year associate degree type programs except the one it had at the Institute of Aviation. On the other hand, the University was to do all it could to help develop competent staff for the high-level programs to train engineering technicians in engineering technology. At this time, we found out about the National Science Foundation Summer Institute programs, submitted a proposal that was funded, and have been operating since that time.

One of the problems that we encounter in a discussion of technical education is the term "technical education." I will make references, of course, to the engineering-related technology since this is my background. However, the same thing can be true for the other areas of training of semi-professional people. The business-related technologies, the health-related technologies, the agricultural-related technologies, plus the engineering-related technologies, are the ones I consider to be the four most active in terms of development. There will be other technologies that develop and others that are considered important by other people, but

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**Oklahoma State University.

if we were to break it down to the four basic ones, I think they would probably cover 80-90 percent of the programs that would be considered in the area of training semi-professional technicians that work with the professional people.

We are able to define engineering to some extent. One reason is that we've had it in this country for about a hundred years. Even today, when you get together with a group of engineering educators, they cannot agree on a definition of what an engineer is. There are some definitions that range from a reference to the application of the forces of nature to the use and convenience of man to rather long and detailed statements of half a page to a page long. We know what a doctor is because we have had doctors for many years, and we can define what sort of training it requires to train a doctor in education. The same situation is applicable to lawyers.

When we get into the area of the engineering technician, we're faced with a relatively new development in our society in America. The concept of the semi-professional has been pretty well established on the Continent--Germany, Austria, Russia, etc.--but in this country, the concept of the technical institute and the training of the semi-professional has been a fractured, fragmented effort. Its history starts back about 1895 with the Pratt Institute, and for further information through the years, refer to the Wickenden and Spahr report that was conducted in the 1920's and published in 1929, 1930, and 1931. It contained a separate section on technical institutes in 1929.

The fact that this report includes many of the ideas we're discussing and rediscovering today impresses and amazes me. It talks about needs; it projects the three to five technicians per engineer ratio that we hear so much about; it talks about staffing, financing, the administrative structure--1929. If you disregard the date and just read the copy, you would think it was written yesterday. I'm a great believer in studying history, but for some reason or another, each generation seems to have to rediscover America for itself.

Of course, there are some things that came along in the 1930's, such as the depression, that caused many ideas (that were to be implemented) to be delayed for a decade or so, but the area of technical education was delayed even longer than that. We were very much aware of its need at the beginning of World War II, when we did not have a pool of trained semi-professional personnel. We had all sorts of emergency war training programs in science, engineering, etc. Therefore, the concept of the engineering technician is somewhat hazy and not only among the professional educators; if it's hazy among them, you can imagine how hazy it is to the students, the parents, and the high school guidance counselors, et al.

It is important that, first of all, we agree on what engineering technology is and what technical education is. I hesitate to philosophize; however, I think we need to discuss some basic terms. These are the ones that are misunderstood most often. I think there are four

basic concepts when we're talking about technical education. We have industrial arts, vocational education, which I like to call occupational education today, technical education, and professional education. These are the four main categories.

I've been before industrial arts groups who claim they are vocational educators. I've been before T & I groups who claim that they are teaching technical education in their high school courses, So, we have, first of all, confusion among the people who are in the field. I've used this comment, and it may be a little harsh or too direct, that in industrial arts, for example, if one has to apologize for the work that he is doing and is ashamed of it, he had better get out of it and do something of which he is not ashamed. Now let's go back and define some of these terms.

Industrial arts, as you know, is an exploratory experience in the sixth, seventh, and eighth grades where the youngsters are introduced to some of the occupations that we have in our society. We have just as much need today for good industrial arts instructors and instruction as we have ever had--probably more so. One of the problems is that many of the people who are involved in this activity have not kept up with the developments in the field. There are a number of definitions of good industrial arts. Gordon O. Wilbur in his book on industrial education includes a quotation wherein he mentions an exploratory experience in the modern and up-to-date activities in our industrial world. On the same page as this definition, which is a good definition, there is a picture of a bench vise with a rectangular piece of metal and a hand file. This certainly is not a modern practice in our industrial complex today, and we need to bring to the youngsters the true concept of what is actually happening in industry.

Then, of course, vocational education, through some mechanism that has developed over the last twenty-five years, has come to be a rather unpopular type of activity in some of our comprehensive high schools. Those youngsters who are troublemakers and can't cope with the college preparatory academic work are unloaded into vocational education. Here again, it gets a second-rate citizenship status. I feel that, in many cases, the educators who have been in vocational education have not met their responsibilities to their profession by tolerating this situation and by refusing to stand up and fight for what they believe to be right. There are good programs in vocational education, but today, I believe occupational education is a more descriptive term. I feel we should not latch onto a term just for status reasons, but occupational education, I think, is a more appropriate term.

The technician is the new breed that comes somewhere between the occupationally qualified worker and the professional worker. We have not had a central core from which to work in terms of developing technical education. The key to this whole program, we feel, is staff. When we first became involved with technical education in the state of Illinois, we did not have such publications as, <u>Occupational Criteria and Preparatory Curriculum Patterns in Technical Education Programs</u>.

Maurice Roney did a wonderful job in preparing it for the U. S. Office of Education while he was working there. Then, about the same time, the publication, Characteristics of Excellence in Engineering Technology Education, came out. I'm sure you've probably discussed both of these. Prior to 1962, we really had no set of standards in terms of identifying what we mean when we say "a program in engineering technology." In fact, that term, as such, was not in very common usage. It was referred to as a "technical institute type" program. In some of our early deliberations, we dwelt on the semantics problem, and, finally, getting rather good agreement among members of the working committee, decided that we ought to refer to these programs as "programs of engineering technology." Engineering is the adjective and technology, then, is the noun as opposed to mechanical engineering programs at the baccalaureate level. This rationale seemed to prevail and satisfy the people working in this area, so we began to use this development around 1962. You can well imagine the problem we have in communicating our thoughts to the student population, their parents, the high school guidance people, and the people throughout education.

We had quite a few conferences in the state of Illinois on promoting technical education. These were two-day conferences that had about seventy people in attendance. The twelve conferences were held over a span of about eighteen months. We put together a road show consisting of two or three persons from the College of Engineering, two or three from the College of Education, and four or five from the State Office who conducted these conferences all over the state to help explain Title VIII of NDEA and technical education as we interpreted it.

In this regard, with the basis we just established in terms of industrial arts, occupational education, technical education, and professional education, we feel very strongly that technical education is a post-high school activity. As a college level program, successful completion should result in the awarding of an associate degree. This is not to say that we disregard the need for post-high school education in occupational programs, but it is the level at which these programs are taught and the requirements in terms of cognitive skill development that are the primary differentiations. Now, in some cases, the program will fall into a gray area, and then it's difficult to say whether it's an occupationally-oriented program or a technically-oriented program. Occupational education normally occurs in a preparatory situation in a secondary school system, with some spill-over into the post-high school system. Occupational education and technical education each has as its respective objective the placing of its graduates into a gainful employment situation.

Approximately 90 percent of the graduates of the technical education programs in the New York technical high schools go on to colleges of engineering. We call this a high school pre-engineering program in our state. I think what we need to do, if we're talking about a comprehensive high school situation, and this again is lacking in the high school, is to build a pre-technical program as a separate curriculum. In some cases, the courses will be the same as for the pre-engineering students; but in the eleventh

and twelfth grades, some beginning exposure to the laboratory type of experience, as opposed to the shop experience, is needed since the shop is more closely related to the occupationally-oriented programs and the laboratory to the technical programs.

In terms of staffing the technical education program, the problem is very acute. We do not have organized teacher preparation programs in the state of Illinois, and we found that we had none organized anywhere in the United States which would prepare teachers to go into the technical areas. We found that the teachers came from all walks of life. In some states, they were predominately engineering graduates. In other states, they were T & I people who had moved up through industrial experience and through other areas into technical education. In other cases, they were industrial education people. There was no uniform format, and so we approached the problem in terms of educational qualifications. It would be ideal to have someone with an engineering background, but this by itself was, we felt, not adequate because a person will tend to reflect in terms of his own immediate and past educational experience and will not have the true understanding of technical education.

In 1959 and 1960, there were a number of meetings conducted to consider the problem of the shortage of qualified staff. As a result of our discussions in the state of Illinois, we had several of the people from the U. S. Office in attendance at some of our meetings--Dr. Arnold and members of his staff. They saw the problem also. In November 1961, the U. S. Office of Education, Division of Technical Education, Area of Vocational Education Branch, conducted a conference. The purpose and objectives of the conference were to determine and to consider technical, professional, and employment experience requirements essential for successful technical teaching; to determine professional technical teacher education for course content; to design a suggested technical teacher education program; and to recommend patterns and operating procedures for the preparation of technical teachers. Most of the persons in attendance were T & I teacher trainers. About twelve states were represented. I'll not get involved in the details of it, but this will give you an idea of the development. About a half page was devoted to the consensus, in terms of the requirements of technical subject matter competency; and amazingly enough, we agreed on that rather quickly. We talked about the ability to use algebra and trigonometry as tools in the development of ideas that make use of scientific and engineering principles, etc., proficiency in the application of physical science, an understanding of the materials and processes commonly used in technology, an extensive knowledge of a field of specialization, communication skills, and the ability to interpret and define principles of economics in industrial relations as applied to technology. Then, as far as technical employment experience, it was agreed that a minimum of three years of employment experience having breadth and quality would suffice. Final determination was to be based on tests or other evaluation procedures. There is two-thirds of the conference, you might say, outlined in a little over a page. When we got to pedagogy, it took four and one-half pages to describe. The reason I bring this out is to characterize the problem we have in developing teachers for

technical education because of the professional pedagogist, a term I apply to a certain group of people with professional pedagogies, who think technical education is just business in the same old shop where potential teachers are given some educational methods courses, psychology of learning, etc. Of course, I'm accused of discounting all this professional education. Also, it is claimed that the engineers don't practice good pedagogy--this is not true. We'll get in a battle over it later, but I don't feel that thirty-six hours of formal pedagogy courses are necessary.

We feel, number one, that in order to be able to teach anything, one has to understand his subject matter. If he is going to teach mathematics, he has to know mathematics. If he is going to teach physics, he has to know physics. If he is going to teach engineering technology, he necessarily has to have some basic knowledge and understanding in the basic sciences and the engineering sciences with their applications, and know their applications to the particular area in which he is working.

In the state of Illinois, we recognized very quickly that we would not be able to attract a significant number of graduate engineers into this program of teaching engineering technology. We are having a small amount of success now, but a number of things have happened since then. In order to develop a competent staff, we had to take the staff then in the field and provide upgrading subject matter experiences for these people. This is the approach that we used in our proposals to the National Science Foundation. At the University of Illinois, we tried to get through the concept that we should develop a special Master of Arts in Teaching for those people out in the field, who had Bachelor's degrees in other disciplines, but then used the Master's degree in Teaching in engineering technology.

When Dr. Roney referred to the hierarchy within a large institution such as we have at Illinois, the above program went through relatively easily. It was approved by the College of Engineering faculty. This in itself in our school is quite an accomplishment, particularly when it includes education courses. The courses were approved by the College of Education faculty and submitted, since it was a graduate program, to the Graduate College. I don't know the situation at the other schools, but the Graduate College at our institution is a separate entity. It has a separate subcommittee on courses and curriculum. The Graduate School submitted the following comments.

Number one, they questioned some of the courses that we had especially designed to cover topics that we would normally cover in the junior and senior years in engineering. They said, "Here you want to give graduate credit in subject matter that is offered for undergraduate credit in the college of engineering. How can you do that?" We said that these were courses for more mature students; they were specially designed courses; the students move faster, etc. This did not satisfy them.

The number two comment was, "Here you are proposing a Master's degree when you don't have an undergraduate feeder program for this Master's degree." Again, this is a pretty difficult situation to resolve.

So we said, "Fine. Answer this question for us. 'Do you recognize the need for this?'" "Oh, yes, there is a need for it." "Then what do you suggest we do?" They said, "We don't know."

They appointed a committee, and the committee was chaired by an Associate Dean of the Graduate College who had his Ph.D. in philosophy. There were about eight or nine people on the committee, and it was a University-wide committee. Dr. Ray Karnes and I were the only ones who really represented technical education. The other eight were from French, chemistry, agronomy, horticulture, philosophy, and psychology; but to make a long story short, after four years of effort, we finally achieved our goal--this program was described in a brochure. Actually, there are two programs described in it. One is a Bachelor of Science in the Teaching of Engineering Technology; the other is a thirty-two semester hour Post-Baccalaureate Certificate in the teaching of Engineering Technology. It's a fine, on-going program now. We thought that it was important that we have three requirements of our teachers for technical education certification. I think we agreed that they would be in this order:

1. Subject matter competency
2. Industrial experience
3. Pedagogic ability

Of course, when this presentation is made to the traditional pedagogists, they disagree, but we've maintained our stand, and I think we've had some acceptance of this concept. This is a new program. It has been in operation less than a year.

The Post-Baccalaureate Certificate is basically the Master of Arts program that we originally presented. One of the things that we have been working on, then, is to identify status with this Post-Baccalaureate Certificate. We have an Advanced Certificate in our College of Education that is about thirty-two hours beyond the Master's, but our Post-Baccalaureate Certificate is thirty-two hours beyond the Bachelor's. It is necessary to have a degree in a discipline other than engineering. Some basic math, science, and physics is required, and if it has not been acquired, it has to be secured on a non-credit basis. At academic year institutes, we have been able to qualify, out of thirty participants, eighteen who will be receiving this Post-Baccalaureate Certificate in the teaching of Engineering Technology at our next graduation exercises.

There are quite a number of problems that remain to be resolved. One of these is that of certification. In the state of Illinois, this is going to be resolved because the junior college system is going to be considered as a part of higher education; and, therefore, it will not be

subject to the state school code in terms of teacher certification and requirements. In the past, we have had to be concerned with certification and some of this inertia, of course, is going to carry over.

We have the B. S. program in the teaching of Engineering Technology. It has been accepted for certification of teaching in the high school, and we hope that some of our people will go into the high school and teach the pre-technical programs that we expect to develop. The junior colleges in the state of Illinois are accepting the Post-Baccalaureate Certificate in the teaching of Engineering Technology as the equivalent of a Master's degree.

There are many problems from the point of view of administration. The administrators are apt to be more flexible in their thinking in terms of what constitutes professional growth and development in their teaching field. Over the last thirty or forty years, the general practice of going back to college every five years and taking five hours of graduate work in education is still in vogue today. There is a course on how to teach mathematics in the fifth grade and another course on how to teach mathematics to the twelfth grade, and both are practically the same. The teachers take these courses only because this is the way their salary structure is written in their particular school system. They have to have "X" amount of credits, regardless of whether they learn anything or not. So, we've had limited success in some of the schools with which we've worked in Illinois, Wisconsin, and some other states in that the school administrators have begun to look at these courses we have been giving in the summer institutes as upgrading course work. In addition, the administrators have been accepting participation in these institute courses as credit in lieu of graduate credit for increments on the salary schedule.

Also, the administrators will have to begin thinking in terms of accepting appropriate industrial experience in place of just plain graduate work as a qualifying part of being a good teacher. Now we get into this gray area of evaluating what acceptable experience is, and here again we have found that some of the administrators really don't know what acceptable industrial experience is. Certainly, if a man is going to teach in the area of machine design or in machine design technology, he should have some appropriate experience working as an engineering technician, a detail designer, or in some kind of a design activity where he has a concept of analysis and synthesis. He should have experience in putting things together and doing the necessary calculation work, drawing the detailed plans, preparing specifications for the machine; and he should know something about how this machine is produced, etc. The administrator has to be educated in terms of evaluating work experience because he is the one who is going to hire the teacher.

We have incorporated in our Bachelor of Science degree program a course labeled as VT 139 for six hours credit. This is not an education

course. It is a supervised summer work experience scheduled over three summers; and for each summer the student works in industry in technically related jobs; he receives two hours credit. We have just started this program, and our intention here is that during the first year, the students would experience the more routine jobs in the area of drafting; and then during the second year, possibly they would get into some more detailed layout work where they help make some of the prelimary calculations. During the third year, they would experience some project type work as they increase in their subject matter competency.

We have been successful in the state of Illinois in educating our administrators of junior colleges to the need of industrial experience. We try to demonstrate and explain to the administrators what industrial experience is and then to equate it in terms of some kind of professional recognition for competency. It cannot be equated exactly in terms of semester hours, but it has to be included in the total picture when talking about technical education. It is easy to identify a math teacher who has had a given number of hours in mathematics, thereby becoming qualified. It's easy to identify a physics teacher or an English teacher, but it is difficult to define qualifications that will enable a technical teacher to do a good job in the classroom.

The McGraw report states that fifty percent of the technical teachers should be engineering graduates. Some critics say that we just want to make this an engineering program. However, they do not go on and read the rest of that important thing--"or equivalent." We have found that we can provide this equivalent by taking selected individuals who have come up through some other discipline. This does not include everybody, but a selected group can take the additional work in the engineering-related sciences. This approach may require an academic year, or a fairly good job can be done in three or four summers. Our participants have gone out and competed successfully for teaching positions in this area because, first of all, most of them have had industrial experience of some kind in addition to all of the pedagogy. They have an edge on the engineering graduate with the pedagogy and experience. With the competency in the engineering sciences and in the engineering technical specialty, they are able to compete very successfully in the classroom. It is this equivalency to which we address ourselves in terms of helping solve the problem of competent staff in a program of engineering technology.

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STAFFING TECHNICAL EDUCATION PROGRAMS
by
Paul K. Weatherly*

South Carolina utilizes a state-wide, post-high school organization that reports to a separate state board. However, South Carolina believes strongly in local control--each technical school operates under a local board with some local financing. We are involved, however, in more than just area technical schools. Technical education also operates special schools to train personnel for industry, technical services which gather labor-research data, and special training programs to meet economic problems.

In staffing single institute technical schools on a post-high school level, it is mandatory to employ the best man available, determined on the basis of proven work record. This person's philosophy should be consistent with the employing body's, and his loyalty should be to the organization.

The objectives of a state-wide or regional group of institutes should be to: (1) meet industry needs; (2) meet local and state needs; (3) provide sufficient commonality to insure transferability of student and/or credits; (4) permit flexibility of administrators; (5) encourage imaginative and enthusiastic leaders; (6) identify and develop positive thinking leaders; and (7) obtain unquestioned loyalty to each other and to the state administrators.

In the past, top vocational education administrators were developed over a period of ten to fifteen years and climbed the ladder the traditional way: from journeyman to craftsman with years of experience, through educational courses and shop teaching, to the acquisition of several degrees, supervision and state-wide experience to the top level administrative position.

Today, this path is an impossibility. The expansion of technical education is occurring at such a rapid rate that the traditional method can no longer be relied upon to provide the number of leaders needed today. Incidentally, there is very little correlation between what is required of a good teacher and a top flight administrative leader.

A technical group tied completely to industry naturally looks to industry and business as a guidepost to develop modern management selection principles.

Modern management believes that the selection of personnel is a specific skill. The principles of selection are based on: (1) the

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experiences and skills of the candidate; (2) the availability of skills through other resource people; (3) the comparison of candidates; (4) the rules and regulations that can hamper the selection of a candidate; (5) the job description; and (6) the defining of the characteristics being sought in a candidate.

In South Carolina, staffing is based on: (1) adding through in-service education; (2) identifying and locating the kind of individual needed; (3) avoiding rules and regulations which prevent the reaching of an objective; (4) operating from job descriptions; (5) allowing trained professionals to do the interviewing; (6) building a team where the weakness of one individual is covered by the strength of another; and (7) beginning a leadership program for recently employed personnel.

A president or a director should be appointed on his ability to understand relationships; to recognize power structures; and on proven administrative leadership, industrial experience, engineering background and education, and training or director experience.

Personally, he should be above average in appearance with an excellent speaking voice. Additionally, he should be dynamic, imaginative, and enthusiastic, and have a positive point of reference.

In essence, a candidate should be selected who has the basic essentials. The selecting body should assume the responsibility for in-service training in order to get the type of leadership the organization desires.

PART VIII

FINANCING TECHNICAL EDUCATION PROGRAMS

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FINANCING TECHNICAL EDUCATION
by
Harmon Fowler*

Technical education is primarily a state concern. Each state makes provision for it in its state plan, utilizing federal funds plus whatever state and local support monies are allocated to it. In some states, all physical facilities are built with state support; in others, this is a responsibility of the local community; and in others, whatever is done is done primarily with federal monies.

In Florida, the technical education program is a part of the state minimum foundation program and is eligible for financial support from such funds for use in high schools, area vocational-technical schools, or junior colleges

Federal funding for technical education is available, if state laws and regulations permit, as a consequence of the following public laws:

1. PL 85-864, National Defense Education Act, first passed in 1958.

2. PL 88-204, Higher Education Facilities Act of 1963.

3. PL 88-210, Vocational Education Act of 1963.

4. PL 88-149 and 88-276, The ROTC program in junior colleges and regulations relating to scholarships and curricula.

5. PL 88-665, Amendments to the National Defense Education Act.

6. PL 89-15, The Manpower Act of 1965.

There are other federal monies which may give indirect support to technical education programs and students. Technical education programs require much equipment and often special facilities.

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FUNDS FOR TECHNICAL EDUCATION
by
Henry Glendenning*

The Federal Facilities Act of 1963 stipulates that an institution of higher education shall be eligible for a grant for construction of an academic facility providing that: (1) in the case of an institution of higher education other than a public community college or public technical institute, only if such construction is limited to structures or portions thereof, especially designed for instruction of research in the natural or physical sciences, mathematics, modern language, or engineering, or for use as a library; and (2) only if such construction will, either alone or together with other construction, be undertaken within a reasonable time.

The grant may amount up to 40 percent of the approved construction cost, but it must be administered through a state agency approved by the United States Commissioner of Education.

The loan program is the same as the grant program; however, the loan may amount up to 75 percent of the approved construction cost. If a grant has been obtained, the total amount of the grant and the loan cannot exceed 75 percent of the approved construction cost.

The interest rate on the federal loan is not less than one-quarter of 1 percent above the average annual interest rate on all interest-bearing obligations of the United States. This is handled by the United States Commissioner of Education through the Department of Housing and Urban Development (HUD).

The Commissioner requires that loans be secured in a manner which reasonably assures repayment. The security may be one or a combination of the following: (1) negotiable stocks or bonds of quality and value; (2) a pledge of unrestricted and unencumbered income from an endowment or other trust; (3) a pledge of a specified portion of annual general or special revenues of the institution; (4) full faith and credit (tax supported) obligations of a state or local public body; and (5) other types of security acceptable in specific instances.

The declared purpose of the Vocational Education Act of 1963 is:

> to authorize Federal grants to States to assist them to maintain, extend, and improve existing programs of vocational education and to develop new programs of vocational education.

A state's allotment under the Act may be used in accordance with

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its approved State Plan for any or all of the following: (1) vocational education for persons: (a) who are attending high school; (b) who have completed or left high school and who are available for full-time study in preparation for entering the labor market; (c) who have already entered the labor market and who need training or retraining to achieve stability or advancement in employment; (d) who have academic, socio-economic, or other handicaps that prevent them from succeeding in the regular vocational education program; and (2) construction of area vocational education facilities and teacher training and supervision.

The amount of grant varies in each state and is administered through an approved state agency.

The Department of Housing and Urban Development (HUD) Loan Program is designed to give long-term loans for the construction of housing, dining, and appurtenant facilities.

Factors to be considered in financial planning are: (1) the appointment of an administrative coordinator in charge of project; (2) the appointment of professional advisors (architectural, legal, and financial); (3) the determination of the scope of the project; (4) the application for the necessary approvals of grants and loans to the proper federal and state agencies; (5) the preparation of studies to determine financial feasibility; and (6) the sale of bonds--if necessary.

OPERATING COSTS FOR
TECHNICAL EDUCATION PROGRAMS
by
LeRoy V. Good*

The patterns of financing technical education programs are many, and the sources of money are varied.

A general rule of thumb is that it costs between $800 and $1,000 per student to operate a two-year program accommodating 2,000 career and transfer students meeting a faculty of 100 or more.

Financing may be done by tax authority boards, state legislatures, and/or the colleges' boards of trustees which may also operate elementary and secondary education programs.

The textbooks suggest that the method of financing should be done as follows: (1) design the educational program(s); (2) cost account it; (3) determine the amount of money needed to satisfy the design; and (4) go to the voters and solicit the money.

There is evidence that this system does not work!

A more sound approach to the financing of technical education programs might be to:

1. Require the students to pay one-third of the operating cost up to $300 per student.

2. Have the state pay one-third.

3. Have the local sponsor pay one-third of the operating cost.

Capital expenses ought to be shared by the state and by the county.

Where students cannot--by law--pay more than $300 per student, it may be necessary for the sponsor to pay the difference.

The amount invested by the state and the sponsor(s) in the preparation of technicians is a very small amount to pay for skilled manpower.

Budgeting of and accounting for the operation of the technical education programs ought to be left to the finance officers and their staffs.

Efficient level of operation depends on scheduling. It is possible

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to get up to 94 percent utilization of space. The State of New York requires only 80 percent. Phase scheduling enables the Monroe Community College to achieve this high percentage of space utilization in classrooms and laboratories.

Phase scheduling requires staggered programs wherein the schedule is divided into three phases by days and starting hours. Monday, Wednesday, and Friday, 8:00 a.m. is Phase I. Phase II is Monday at 9:00 a.m., and Tuesday and Thursday at 8:00 a.m. Phase III is Tuesday, Thursday, and Friday at 9:00 a.m. Never are there more than two phases immediately adjacent by a day and one hour apart.

Classrooms and laboratories should be utilized at all times. School administrators should make the percentage of space utilization as high as possible.

Clock hours for teachers in contact with students should average between fifteen and twenty per week. Faculty ought to be expected to accept assignment over a fourteen-hour day where the same programs are operated day and evening. The maximum spread per day, five days a week, for a teacher should never be more than eight hours.

Programs should not be offered on the basis of popularity but rather on the basis of realistic cost accounting.

PART IX

SUPERVISION AND IN-SERVICE TECHNICAL TEACHER EDUCATION

PROGRAM EVALUATION AND REVIEW TECHNIQUE

by
Earl Blekking*

During this brief period, we hope to introduce you to the application of PERT (Program Evaluation and Review Technique) to educational situations. My comments are based upon an article by Kodet and Bruce which appeared in the November 1964 issue of Spectrum, a periodical of the Institute of Electrical and Electronic Engineers.

PERT is a planning and control technique for modest task application as well as for large programs necessitating elaborate, computer-based applications.

Advantages of the technique are:

1. A disciplined approach to planning.
2. A method of visualizing the work and of communicating plans.
3. A plan which can reflect uncertainties but which can also be easily used for calculating the time to perform the project.
4. A means for appraising progress and forecasting problem areas.

PERT is a planning and control discipline which employs a specific set of principles, methods, and techniques for effective planning. The key elements of this discipline are:

1. A work breakdown structure which begins with the objectives and sub-divides them into successively smaller elements of work.
2. A network, comprising all the work which must be accomplished to reach the objectives, and depicting the planned sequence of accomplishment of this work as well as the interdependencies and interrelationships.
3. Elapsed time estimates of work to be performed and schedules which also consider the availability of resources.
4. Analysis of the interrelated networks and schedules as a basis for continued evaluation of performance and identification of problem areas.

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**University of Florida.

PERT is also a discipline for organizing data, documenting the plan, and manipulating the plan to effect a successful conclusion to the project. The statement that PERT is a discipline and a tool for planning and controlling a job is significant to an understanding of the technique. Although the technique is formalized, it is no different from what any of us must orginarily do to plan and control our work properly. The elements of this technique had their origin in engineering applications. It must be remembered that PERT is not a panacea or substitute for the decision-making process; it is only a tool to aid the decision makers.

Before any task or project, large or small, can be undertaken, it must be defined. The definition and objectives must include the work tasks or work packages. Such definitions result in a road map for planning or Network Planning. Networking techniques were derived from flowcharting used in computer programming. Networking is a logical discipline for planning a task. It is not the network which is prepared; it is the plan which is prepared, using network discipline.

The discipline of planning can be defined by a series of questions which must be answered:

1. What work must be performed?

2. What is needed to perform this work?

3. How will completion be identified?

4. How long will it take to perform the work?

Simply, a PERT network or chart is made up of two elements--events and activities. Activities are the work to be performed and are signified by arrows. Events are specific definable achievements--either the beginning or completion of one or more activities--and are represented on the network by circles, ellipses, rectangles or other geometric figures. Every activity is bounded by an event at the beginning and an event at the end.

Once the network has been developed, portraying the relationships and interdependencies among the activities, the time needed for each activity should be estimated. Three estimates of time or duration of the activity are defined as:

1. Optimistic time--(a) --The time the activity will take if everything to be done is done successfully the first time.

2. Most likely time--(m)--The time required to accomplish an activity under normal circumstances with some success and some failure.

3. Pessimistic time--(b)--The time the activity will take with extremely bad luck.

PERT Time Estimating

There are two basic methods of time estimating--probabilistic and deterministic--and the use of one or the other is optional. Probabilistic time estimating, which was developed as part of the PERT system, requires three estimates for the duration of an activity, according to the definitions previously stated. The three estimates provide a means of assessing the risk being taken in performing the job. It is specifically designed for uncertain nonrepetitive types of work.

Deterministic, or single time estimating, on the other hand, does not utilize probability weighting. The engineer or technician director can make one estimate for the length of the activity which is the time he needs to accomplish it. The single time estimate has been used mainly in process industries and construction where it has been found valuable. CPM (Critical Path Method), which is a networking system employing a slight variation of PERT in terms and methods of network preparation, also uses one time estimate.

Once the time for the activities has been estimated and, in the case of the three-time-estimate system, the expected time for the activity calculated, the expected length of the project can be calculated. These calculations are usually referred to as: (1) earliest expected date; (2) latest allowable date; and (3) slack. Slack is the time difference between the earliest expected date and the latest allowable date. Slack can be positive, negative, or zero. When the latest allowable date is later than the earliest expected date, positive slack exists. Negative slack exists when the opposite occurs. Zero slack occurs when the earliest expected date and the latest allowable date are the same. Positive slack is "time-to-spare."

The longest time path or sequence of activities through a network is called the critical path. This path controls the completion date for the task(s)/project(s) represented by the network, since all other paths are shorter. The slack time for the critical path is zero. If the length of time for the critical path exceeds the established date for completion, then the critical path has negative slack. The longest time path is the most critical in relation to the established completion date and hence is called the critical path. All other paths which are shorter than the critical path are, therefore, called slack paths.

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ACCREDITATION

By

William L. Bolin*

An understanding of the purpose, philosophy, and mechanics of accreditation are essential for the educational administrator. The diversity of educational institutions in philosophy, definition, and derivation is recognized and encouraged. However, some means of comparing and equating them are necessary to provide for the mobility of population in the United States.

Educational accreditation involves several basic types: state, regional, and special. Each accrediting agency has its own philosophy, purpose, and standards for evaluation.

Each state is directly responsible for the type and quality of state supported institutions. This responsibility includes establishment of minimum criteria, evaluation against these criteria, and approval of the institution to operate. Specific methods, standards, and techniques vary from state to state.

Regional accreditation is accomplished by a voluntary, self-governing association of educational institutions. The purpose is to develop and maintain sound educational standards. Membership in the organization denotes formal accreditation. Accreditation signifies that a school or college has been carefully evaluated and found to be following basic educational policies, practices, and standards comparable to other member institutions.

Specialized accreditation refers to a portion of the total educational program of an institution, usually a single curriculum. In the engineering-related technologies, the Engineer's Council for Professional Development (ECPD) is the agency responsible for accreditation. The ECPD accredits curricula in colleges of engineering and engineering technology curricula. This accreditation is voluntary and gives professional endorsement. Many companies realize the significance of this accreditation and require graduation from an ECPD accredited institution as a prerequisite to employment.

The Council on Dental Education of the American Dental Association inspects, evaluates, and accredits schools preparing dental hygienists. This accreditation is independent of regional accreditation but must be obtained prior to graduating the first class.

There are several other special accrediting agencies, such as the National League for Nursing and the Council on Hotel, Restaurant, and Institutional Education.

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**University of Florida.

The type accreditation sought will depend upon the philosophy of the institution, legal requirements, and the ability to place students appropriately. It would appear that accreditation is becoming increasingly more important, and if the institution is to serve its graduates most effectively, it is a prerequisite.

EVALUATION, ACCREDITATION, AND INTEGRATION OF CONCEPTS FOR TECHNICAL EDUCATION

by

Lynn A. Emerson*

Industry regularly takes stock of its programs in the form of consumer research, product research, personnel audits, sales analysis, market analysis, and financial analysis. All are applicable in the assessment of technical education!

Steps in the evaluation process involve: (1) stating goals and objectives; (2) determining indicators of progress; (3) selecting and/or devising measurement instruments; (4) selecting measurable samples; (5) measuring selected samples; (6) comparing results with stated goals; (7) analyzing findings; and (8) developing recommendations for program improvement.

The basic goals of a technical education program are to meet the needs of employers for technician personnel, to meet the needs of students; to provide satisfying experiences for the school staff, and to provide a program that satisfies the public.

Items which need evaluating are the product (graduate), the organizational pattern, the effectiveness of administration, the curriculum, the instruction, the physical plant, fiscal accounting, operating costs, and guidance and placement services.

Instruments of evaluation include a review of placement records, attrition, growth, costs, enrollments, curriculum offerings, and the results of an opinion survey.

Continual assessment of program indicates change--change in organization, levels of education, curriculum, general education, methods of instruction, plants and equipment, teacher education and qualification, supervision and administration, occupational guidance and information, pre-employment and extension programs, preparation of youth for change, balance in education and training responsibilities, recognition of public and private educational functions, utilization of existing agencies, use of economic and labor data, resolving power struggles, regionalization, accreditation, student expenses and financing, research, master plans of education, and planning.

These needed changes call for an integration of concepts; one agency alone cannot do the job.

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PART X

ESTABLISHING RESEARCH IN TECHNICAL EDUCATION

RESEARCH IN TECHNICAL EDUCATION

by

Carl J. Schaefer*

The advent of 17.7 million dollars for occupational research and planning makes it crystal clear that there are problems which need solution. The research capabilities of education number about 3,070, and vocational education approximates fewer than 100 competent researchers. Obviously, we need to examine and strengthen our determination to mount a more adequate program of problem solving.

Educators, and vocational educators in particular, are quite naive when it comes to sophisticated problem solving. Enough formal research just isn't in evidence in vocational education. Since the conception of the Cooperative Research Program, vocational education has had less than a dozen studies approved for grants; and under the Vocational Education Act of 1963, proposals submitted by vocational educators are conspicuous by their absence.

Lawrence W. Prakken editorializes that:

> Changing of habit patterns of long standing is difficult and disconcerting. Problems of curriculum, courses of study, equipment, facilities, and staff are compounded by the new and broader approach vocational education can take..... Adding these new responsibilities does not mean that the old programs are bad--they just are not enough to do the present-day job. We will have to live with change.....and make every effort to adjust to new requirements, new administrative organization and changing responsibilities.

Change in our field is a must; but to know what changes produce what results and why, are the keys that need to be accounted for through research.

The development of a research proposal is a sizeable undertaking--with stumbling blocks--involving the following process: the incubation period, the prenatal care period, and the delivery.

The incubation period, of course, includes the focusing on a problem, the exploring of personal strengths and weaknesses relative to the problem and the business of research, the delimiting of the problem, the searching for funds to conduct a sizeable study, the development of the format, and the writing of the proposal, which includes the problem

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statement, the review of existing literature, the procedure section, and the budget.

Prenatal care of a research proposal involves careful attention to a well thought out plan--the writing, editing, typing, and duplicating of thirty or more copies; and the submission of the proposal within specified cut-off dates.

The waiting for a reply is a frustrating experience, and premonition is usually worthless. The delivery can be quite emphatic (Yes, we are interested, or no, we are not) or subtle--the United States Office of Education uses a lettering system to announce a proposal's status.

A few pointers might be worthwhile:

1. Sizeable amounts of state and federal funds for research are available.

2. Several sources of funding--Ford Foundation, Cooperative Research Program, Sears Roebuck Foundation--are also available.

3. Contracts officers in institutions of higher education can be of immeasurable assistance in preparing the budget phase of the proposal.

4. The principal investigator's talents are being sought, and he should devote more than one-fourth of his time to the project.

5. Assistance in revision of a proposal is available from the person monitoring the proposal.

6. Additional funds--usually small--can be requested, and the original budget request can be reduced if necessary.

7. The research grant is the right of the researcher and not the institution to which the researcher is attached.

In conclusion, it is submitted that vocational educators have a long way to go to develop a real research capability; that an interdisciplinary approach to vocational education problems is looked upon with favor; that the vocational program of research is not a moonlighting business, and that vocational education must get geared up to the research job in terms of competent personnel, time, and financial assistance.

Vocational educators must administer research programs well, for whatever is done must reflect the quality of vocational education's product and not the mass production of more of the same.

ORGANIZATION FOR RESEARCH IN TECHNICAL EDUCATION
by
Leon Sims*

My remarks are limited to the organization for research in vocational-technical education currently in effect for the state of Florida. Perhaps you can draw some useful parallels, or develop some ideas appropriate to your own situation, from this presentation.

The Florida Vocational Program Research Coordinating Unit has been established as a part of the Division of Vocational, Technical, and Adult Education of the State Department of Education. The purpose of the unit is to coordinate and encourage needed studies in vocational-technical education.

The unit seeks to accomplish its purpose by providing interested agencies with information and assistance in the preparation of research proposals, securing grants, coordination of research effort, and dissemination of the results of completed studies.

In addition, the unit provides other services, such as conducting seminars, compiling and disseminating abstracts of studies, identification of resources, compiling data on vocational needs and program potential, and providing consultative services.

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RESEARCH IN VOCATIONAL AND TECHNICAL EDUCATION

by

J. Paschal Twyman*

More and more we are recognizing the fact that research is one of the valid techniques by which we can seek tenable solutions to pressing problems. Any adequate definition depends upon both the techniques utilized and the purposes for which the research is conducted.

Whereas the Federal Government has for many years been very successful in providing funds for development and training, it was not until very recently that funds were available for associated research and evaluation.

Research is marvelously broad in its applications. From the standpoint of the administrator of technical education, then, the problem at hand is one of determining something about the nature and scope of activities designated as research and the applicability of these activities to the problems in technical education. Finally, we should probably explore some guidelines for the preparation of research proposals.

Overview of Research

Just what is the meaning of the term, "research"--a term which has turned into such a status symbol?

We might suggest, first, that research probably achieved much of its popularity because of its useful connotations rather than because of its specific denotations. It has been, depending upon the particular frame of reference used, applied to such activities as fact-finding, pupil-accounting, arranging of teaching schedules, etc., as well as to broad problem-solving activities like testing the effectiveness of particular teaching techniques, the impact of particular curriculum innovations, etc.

A general definition of research--"Research is a systematic and refined technique of thinking and acting, employing specialized tools, instruments and procedures to achieve a more adequate solution to a problem than would be possible with ordinary means"--places the emphasis on the problem-solving activity; and by its use, I am implying that the primary value of research is in providing new insights, demonstrating new relationships among variables, and, in essence, describing our social environment in some meaningful way.

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Adequate research is characterized by:

1. Objectivity

2. Measurement

3. Statement of questions or hypotheses

4. Development of a design or plan of attack which will provide answers to these questions or provide for a test of these hypotheses

5. The making of decisions regarding questions or hypotheses tested.

6. A continuous search for new data or concepts bearing upon the original problem

Types of Research

We have talked about research according to the following categories: historical, descriptive, and experimental.

Historical research is designed to explain, "What has been." This type of research is predicated upon the assumption that we can better understand today's problems if we know something about past trends. Characteristics include objectivity (attempts to report on the parade of events that have occurred rather than to justify them), inductive logic (the investigator seeks to accumulate all facts from which he then develops his ideas, concepts and principles), and non-repeatability. Sources of data include both primary and secondary sources.

Descriptive research deals with, "What is." It is predicated upon the notion that it is necessary to know where we are and what we have accomplished in order to know what we need to accomplish. It also provides a picture of things as they are at the time of the study.

Experimental research answers the question, "What will happen if we manipulate certain variables and control others?" It cannot indicate what should be. Variables are classified as independent, intervening, or dependent.

With this background in mind, let us turn now to some more basic and detailed questions concerning research: (How does one do research?)

1. First of all, a decision should be made concerning whether research is needed in any given situation. Any problem finally chosen should meet the following criteria:

a. Be a problem in which the investigator has a high degree of interest.

b. Have general interest and social significance.

c. Be a problem for which the data is available.

d. Be manageable in terms of time and effort required.

2. Once we recognize a problem, we define it as a problem for someone. This means that we must consider questions of sample and population.....

3. Data collection

   a. Questionnaires--open ended, closed ended

   b. Interviews

   c. Behavioral observation

4. Data analysis is a key part of the research process. It should be noted that information in a research study is determined by how the data is collected but defined by the method of data analysis. Steps in data analysis include tabulating (putting into appropriate form) and subjecting it to some form of quantitative procedure, i.e., assigning numbers to the data. Data should be analyzed in terms of the objectives, hypotheses, or questions of the study.

5. Interpretation--Conclusions and Implications

   a. The major part of the study has to do with the conclusions. This is more than just summarizing the obvious factors--it requires insightful interpretation. Any reports prepared on the research should be pointed toward a particular audience and should give enough detail regarding procedures so that anyone else using the same approach could achieve similar findings.

The overall purposes of research are twofold: to solve some immediate problem and to develop some theoretical structure which will serve as a roadmap for others with comparable problems at some future point in time.

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PART XI

PUBLIC RELATIONS IN TECHNICAL EDUCATION

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PROVIDING PUBLIC INFORMATION
by
Burr D. Coe*

The purpose of area vocational schools is service to the community through vocational education and training programs of broad scope; however, the job can't be done in a vacuum--buildings and equipment are needed. Therefore, a public relations program is a must since the people need to be convinced of the necessity and value of the vocational education facility.

The heart of the problem in mustering support for the program is "getting the people to tell the people who control the funds of the need for vocational education." Providing information to the public can be done in several ways:

1. Through the newspapers, which are considered--by many public relations studies--to be the most effective media for telling any story.

2. By enlisting and respecting the support of the newspapers; the papers can provide support through editorials, feature stories, and general news stories.

3. By accepting public speaking engagements and appearing before civic organizations; this is another excellent way of getting the message across to the public.

4. Through printed materials of a promotional nature; these might include guidance booklets, program brochures, and/or annual reports. These are costly and perhaps provide the least return for the monies invested.

5. By utilizing advisory committees. Advisory committees provide an educational value, an expertise value, and a placement value to the school since the committees' members are associated with the unions, industry, and management.

6. By conducting surveys to determine the expressed needs of students and employers so that the programs are kept modern and in line with community needs.

7. By cooperating with other agencies--educational, industrial, and institutional--in the community.

8. By encouraging change in existing statutes, policies, and practices which hamper the expansion of vocational education

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programs. This can be done by seeking the support of and cooperating with national, state, county, and local legislators.

9. By identifying trends and preparing for the changes which are inevitable.

At the present time, vocational education programs depend primarily on local support, and contacts with the local populace must be maintained. Public relations is a must!

PUBLIC RELATIONS FOR PUBLIC EDUCATION
by
John B. Moullette*

Keeping the public informed about the schools is a continuous responsibility of school administrators. However, this responsibility is often interrupted or neglected by the pressures of the administrators' busy days. Consequently, the public suffers and is not as fully informed as it should be and must be today in a societal area of responsibility where the complexion and the goals are swiftly changing.

The front pages of our newspapers attest to the essentiality of educational public information programs, and the professional educator is taking more time away from his traditional and accepted educational responsibilities in order to explain or defend a position which might have been handled more fully and more competently in a pre-planned public information program.

In order to obtain public support for education and especially vocational-technical education, an effective public relations program is needed.

The educational public information or public relations program should make education better understood and better known.

Walter R. King, Special Assistant for Public Relations to the New York State Commissioner of Education, submits that:

> Public relations should not only be the voice of management in education, it should have a voice in the management of education.

Public relations in public education is that function of administration and management which gives the same organized and careful attention to the asset of good will as is given to any other major asset of the business of public education.

In 1950, the American Association of School Administrators devoted its 28th Yearbook to "Public Relations for America's Schools" and established the following comprehensive objectives: (1) to inform the public about the work of the schools; (2) to establish confidence in the schools; (3) to rally support for proper maintenance of the educational program; (4) to develop awareness of the importance of education in a democracy; (5) to improve the partnership concept by uniting parents and teachers.....; (6) to integrate the home, the school, and the community in meeting the needs of the children; and (7) to correct misunderstandings as to the aims and objectives of the schools.

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**Rutgers - The State University.

The list is broad, and direction has been left to those interested but not contracted for this educational responsibility.

In the area of identifying publics, the interested public relations practitioner can only identify three: (1) those who oppose public education; (2) those who are indifferent to public education; and (3) those who support public education.

They are uncertain why the publics fall into these categories; and they feel, too, that using the same materials, the same methods, and the same information simultaneously to reach these audiences is ineffectual.

The method of attack is wrong. The "shotgun" approach must be abandoned in favor of the logical approach wherein samples of the population's attitudes for and against public education are polled and wherein conceptions and misconceptions of public education are learned as well as the values of the persons who hold these attitudes.

Basically, a public relations program must be clear-cut as to purpose and sufficiently financed to serve the purpose; and it ought to center on three central endeavors: publicity, communications (that activity that transmits policies and engenders closer relationships and willing cooperation among personnel), and the training of upcoming PR practitioners.

Sometime ago, Melvin L. Barlow wrote in the AVA Journal of the dissolution of vocational education in Any City, and he warned:

> No time for public information is a dangerous disease.

With this in mind, it is recommended that educational administrators:

1. Learn the attitudes of a variety of target groups toward vocational education.

2. Establish and budget for a formal public information program.

3. Appoint a public information practitioner with abilities in writing and publicizing, communicating, and training.

4. Permit the PR practitioner to have the same latitude for operation as any other administrator would have.

5. Don't burden the practitioner with tasks not directly related to the described public information responsibilities.

PART XII

SUMMARY OF INSTITUTE PRESENTATIONS

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SUMMARY OF PRESENTATIONS OF THE
COLORADO INSTITUTE
by
Jack Annan*

The Role and Responsibility of Leaders

Leadership is defined as an expression of the relationship between the leader or the guider and the follower.

A. Situations that must be handled by a leader in decision-making:

1. Time is great essence and someone far above us wants the decision and wants it immediately.
2. A person makes a decision and then sells his decision to his colleagues or his followers.
3. A person makes a decision and then it is subject to change.

B. Responsibilities of a leader in any situation:

1. To improve the quality of all the decisions made under his guidance.
2. To develop teamwork and good morale among his colleagues.
3. To further the development of the members of the group.

Rationale and Need for Technical Education

Effective technical education produces graduates with the following characteristics:

1. Capable of entering an occupation requiring scientific knowledge and skills.
2. Able to progress rapidly on the job.
3. Can pursue additional course work.
4. Qualified to handle communication skills and practices of desirable citizenship in the home and community.

The shift in educational emphasis is from "doing" to "thinking plus doing."

Placements of technicians show that:

1. Most states have rather complete records of placement.

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2. Well prepared graduates of technical programs are in great demand.

3. It is important that placement and follow-up records are gathered and maintained.

4. Placement is a part of evaluation essential for an effective technical education program.

Effective technical education:

1. Must be based upon the knowledge and skills essential for those occupations supporting professionals or for occupations which require comparable preparation.

2. Adequate time must be allotted to specialized subject matter--approximately 1,000 clock hours.

3. Particularly in a comprehensive institution, administration must understand and fully support the program.

4. Placement and follow-up of graduates is a vital part of program.

Labor Market and Growth Trends of Population

Those who plan a program of technical education and develop facilities only for the local areas are making a tragic mistake. Not too many years ago, we were taught that the primary responsibility was to take care of the needs of the community for skilled workers and other individuals. Today, in technical education, this is no longer true. The community is our county, our state, and in many cases, an area and conceivably the nation.

Population trends in the age group 18 to 21:

1940	1.8 million
1965	12.1 million
1980	19.6 million

This shows the increase in population that we must train.

The change in the labor force numbers is also very revealing in the age group 13 to 34.

1950-60	366,000
1960-70	6,606,000
1970-80	303,170

Figures also show that in the 14 to 19 years of age group in 1965, there will be 14 percent more females to train as compared to 8 percent more males. This means, to us in technical education, that we will be training more women.

We also know that women enter the labor market early; then in many instances drop out when they are raising families, and then come back into the labor market at a later date. However, the trend is changing in that large numbers of the women entering the labor market are staying.

The percent of our population that was unemployed is as follows:

1929	3%
1931-39	5%
1949	6%
1951-53	3% (Korean War)
1954	6% (After Korean War)
1962-66	5-6%

Those in economics tell us that in all probability the country can expect to have 3 to 5 percent unemployed at all times. The Manpower Programs will help train many of these people.

As the farm population continues to move to urban areas, these people must be retrained for new jobs.

Sources of Technicians

We are all aware that new industries are rising, new processes are being developed very rapidly, and more and more jobs beyond the complexity of the skilled tradesman or craftsman are coming into the picture.

The sources of technicians are listed below:

1. On-the-job trainees.
2. The ranks of skilled craftsmen.
3. Those who have acquired technical competency through various types of study.
4. Schools conducted by the armed forces.
5. Dropouts from college engineering courses.
6. Engineering graduates occupying technician positions.
7. Technical institutes, junior and community colleges, and vocational and technical schools.
8. Workers who attend part-time courses while employed by industry.

We need better qualified technical institutes and/or programs that begin at the point where the engineering colleges have stopped.

Survey Methods Employed in Denver

Since 1950, Mr. R. K. Britton has surveyed Denver high school graduates and has worked with high school vocational and career counselors in developing a questionnaire to be used in interviewing employers and graduates. The counselors personally took the questionnaire to the employers and talked with the employment manager and the supervisor of the individual.

The Board of Education actually finances this survey. A staff of about 10 people survey about 1,700 post-graduates each year who are working in industry. The counselors in turn collect and summarize the data. The results point out the strengths and weaknesses that relate to any particular high school, and work is done to strengthen the areas which need help.

It is felt that this type of survey pays dividends. If the future students can be helped by introducing a revision in the training program, then much money can be saved by the city and county of Denver and by industry in that area, by providing new courses.

Panel--Assessment of Present and Future Needs in Technical Education

A summary of the panel discussion indicated the following:

1. We should be doing what is needed in the technology by industry and employers.
2. There should be a need in the local area or within the state before courses, designed to meet that need, are offered.
3. In some areas, 50 percent of the population is mobile, and many move after they are trained.
4. Local surveys are important, mainly in the contact that is made with industry.
5. The Chamber of Commerce can aid in gathering information.
6. The State Industrial Commission and the Department of Labor are also able to aid in determining future needs.

The Employer's Need for Technicians

Our society is built on the "Indians," not the "chiefs." This means that we need more people in the vocational types of programs. Too often,

a college education is emphasized to the point that people believe anything else is second-rate. This attitude is wrong.

Reasons why well-qualified young men are discouraged from entering any of the skilled trades are as follows:

1. The attitude of a few school administrators, counselors, and teachers, who believe that any position other than professional is second-rate.

2. The attitude of some people who believe that it is unnecessary to use your head if you use your hands.

3. The attitude that all education is confined to the college campus and that you must have a college degree before you can seek employment anywhere.

4. The attitude of many adults and students toward hard work and dirty hands, which are still honorable and necessary.

5. The absence of a good public relations program by industry, portraying the skilled trades and their true contribution to society.

Apprenticeship is one of the finest opportunities offered to youth. It should be treated as such and granted only to those who are the very best and the most worthy.

There is a definite need for skilled tradesmen in our society, and industry is presently beginning to become aware of the shortage that exists. We need suggestions and comments from educators who realize that there is an urgent challenge before us.

Metro Dropout and Reclaiming

Too often it is found that a dropout is not really a dropout. He is a push-out. There are people who will not realize that there are two sides to the coin--the student's and the teacher's.

In a Denver survey, it was found that of 2,300 high school dropouts, only 209 had IQ's below 80 and that 573 had IQ's over 110. This showed that poor achievement was not the sole reason for dropouts.

A school called the Metropolitan Youth Center was established to take persons who had dropped out of the full-time school. It was designed on a "work at your own speed" basis.

Personal counseling and job placement is provided by the school.

Plans are being developed for further expansion of the facilities for this program.

Description of the Technical Education Student

Technical education must be concerned with the concept that different levels of programs must be provided to meet the variety of needs of our society, both from the industrial business world and from the individual ability concerned.

If we agree with the concept that future post-high school institutions are going to be as commonplace as our high schools are today, then newly established technical institutions must be located close to where the students live. These should be low-tuition institutions so as to make it possible for people from the lower economic levels to benefit from vocational-technical education.

Points concerning the technical education student are as follows:

1. Too many times we look for students in the craftsman and technician areas where their fathers are employed.

2. We should look for future students from many different areas. Many will come from the working and labor class of people.

3. Many future students will come from professional families.

4. Only students who can profit from technical education programs should be enrolled.

5. An institution needs a program with size enough to offer a variety of programs.

6. A good technical school can make a good technician out of an average student.

7. Programs must be established for persons of all age groups for retraining and upgrading.

8. We need to take more responsibility for a broader spectrum of student interests and abilities and of occupational programs so that we offer programs that will fit the various abilities, backgrounds, and aptitudes of our society.

9. Courses must be offered in mathematics, science, and English to help build up the students' backgrounds.

Factors for consideration in attracting and selecting students are expressed in the following statements:

1. The entrance requirements must be communicated to the high school counselors and the community at large.

2. Previous research must be reviewed concerning the selection of students.

3. Students should be made aware of the dollar value of technical education.

4. Basic qualifications for students should be established for each occupational program.

5. An effective device to attract students is by means of an attractive brochure.

6. Newspaper publicity is beneficial.

7. Aptitude test scores aid in student selection.

8. Individual counseling of students prior to enrollment is beneficial.

9. Upon organizing an institution, students themselves can be asked to help set up the student organizations and activities.

To be successful, an institution must clearly define its objectives. It must communicate these objectives, and it must carefully perceive the type of student that it wants to serve.

Administrative Structure of Technical Education Institutes

Ten years ago, there were fewer than 500 public institutions offering post-secondary occupational education in America. Today, there are approximately 1,000. Ten years from today, using the same rate of growth, a conservative estimate would increase this number to 2,000 institutions offering vocational training after high school.

These institutions may be grouped according to five types of organizational structure: (1) the high school; (2) the vocational-technical school; (3) the technical institute; (4) the community or junior college; and (5) the university. Under the Vocational Education Act of 1963, all of these institutions meeting an area criterion may also be classified as an "area vocational school." Each of these schools performs a necessary function in post-high school occupational education. Their unique characteristics may be described as follows:

High School--A secondary school offering post-secondary occupational programs, in addition to its regular secondary vocational curriculums.

Vocational-Technical School or Institute--A school specializing in occupational education which may operate as a high school, although it is usually a post-high school institution. It may be administered by a local school district, a county school system, or it may be operated as a state school.

Technical Institute--A highly specialized single-purpose institution offering training in technical occupations. Emphasis is placed on the application of the functional aspects of science and technology.

Community or Junior College--A two-year college providing short and long-range occupational training, as well as academic college parallel programs.

University--A division or department of a four-year institution offering occupational curriculums designed to equip persons for useful employment in recognized occupations which require less than a baccalaureate degree for entry.

Some beliefs concerned with technical education are listed below:

1. I believe occupational education is part of the total American educational system.

2. I believe that teaching is the most important vocation of mankind.

3. I believe that every student has a creative spark and that development of this spark is the teacher's most sacred task.

4. I believe there are no poor teachers, only unawakened teachers.

5. I believe there are no poor students, only unmotivated students.

6. I believe in men rather than buildings, in values rather than statistics.

7. I believe that not only the program of instruction but also the institution operational policies should be student-centered.

8. I believe the human element in challenge can motivate individuals to achieve much beyond their predicted capabilities.

9. I believe that people are willing to involve themselves in difficult situations and problems to the limit of their capacity, but often we underestimate the individual's capacity for growth.

10. I believe that man is what he thinks he is and that he may become what he wants to become.

11. I believe an institution should be carefully planned and programmed, not only for its purpose today but also for its future for tomorrow.

12. I believe that area vocational schools and community colleges will carry the largest responsibility for occupational education in the United States, or at least they are doing so today.

13. I believe that occupational education in America can best be accomplished in specialized institutions, such as technical colleges and institutes, but it is more likely that it will be done in the comprehensive institutions.

14. I believe that quality technical schools can produce quality technicians from students of average academic ability.

15. I believe that technical schools need to concern themselves with teaching much more than technologies.

16. I believe that occupational education will have to be made co-equal to academic education.

17. I believe that community colleges will have to develop more effective methods of providing occupational programs.

18. I believe that every citizen has the right to at least two years of college education.

19. I believe that too few of our youths go to college, far too many of them drop out of college, and far too many drop out for the wrong reason.

Facilities and Equipment for Technical Programs

In the establishment of a technical program, it is necessary to complete a master plan early in the development of the program. Some of the planning details are as follows:

1. Determine how many students there are in the area to be served.

2. Determine the enrollment of the institution.

3. Locate the main campus in the center of the population concentration.

4. If necessary, locate other campuses on the outer fringes of the area.

5. Locate the campus near freeways that are easily accessible.

6. Locate the campus where it can best meet the needs of the students.

7. A rule of thumb for basic operating costs is $1,000 per full-time student.

8. A rule of thumb for equipment costs is $2,200 per full-time student.

9. One might allow 130 square feet of building space per full-time student.

10. Many times it is wiser to rent temporary buildings and spend ample time in planning.

11. Plans should be made to landscape the campus to make it attractive.

12. Laboratories should be built for many purposes.

The department heads should be given the authority to make up the proposed equipment lists for each year. Many times, the department heads have to be encouraged to spend the finances instead of discouraged. Each department should take the full responsibility for ordering equipment, with some administrative guidance as to how much money it can spend from the budget.

The key to illumination of buildings without windows is to have sources of light very high in the corridors. This illumination should equal one hundred foot candles.

The trend now, particularly in the warmer areas of the United States, is toward air conditioning. This enables institutions to utilize the buildings throughout the summer. The environment is the key factor as to whether or not the institution will have the adequate enrollment to operate in the summer.

Depending upon the type of technical education program, a suggested ratio for laboratories and classrooms is 55 percent and 45 percent respectively.

Many institutions are going toward a fairly elaborate board room and a separate conference room.

Institutions that have a highly organized student body that engages in extra-curricular social activities and athletic and physical education programs, find it necessary to have additional student officers' and conference rooms.

A budgeting figure to keep in mind for developing a library is $100 per student enrolled.

To facilitate the food problem, many small institutions use dispensing machines. It is very helpful to have a full-time attendant stay with the machines to supply and clean them and to clean the area. Another course of action is through a cafeteria. The suggested figure the first year for cafeteria supplies is $75 per student and $50 the second year.

Panel--Development of Laboratories

A summary of the panel discussion indicated the following:

1. The institution must work very closely with the architects.

2. The teacher should assist to some extent in the planning.

3. Care must be taken to include everything needed in the architect's preliminary plans.

4. Possibly 125 square feet of space for study is adequate.

5. High quality equipment and materials should be purchased.

6. Plans should be made far enough ahead so that the requisitions can be approved by the state department if it reimburses part of the purchase cost.

Conference Facilities

1. A common facility needs to be provided for use by both staff and students, or there could be multiple conference rooms.

2. The institution should offer its facilities for community conference use. A fine public relations image is provided.

3. A small kitchenette adjacent to the conference room is a helpful facility.

Library Facilities

1. It is unique and helpful to the students to have 100 percent open stacks.

Anticipatory Planning

1. Constant planning for the future is necessary.

2. The institutions must do all they can to recognize the needs of the future.

3. Plans should be made to teach some future jobs in a different way, using a more modern approach.

Cafeteria

1. A good possibility is dispensing machines.

2. Small cafeterias in many institutions are prevalent.

3. Some institutions utilize food service instruction in connection with the cafeteria facilities.

4. A cafetorium can be located so as to use it as hallways, study areas, or lounge areas when it is not being used to serve meals.

5. The absolute minimum space to allow per student is fifteen square feet with twenty-five square feet being more realistic.

Program Patterns and Curriculum Development

The central concern of technical education is with a body of knowledge rather than with specific jobs.

The basic problems in nearly every vocational-technical program in the country are those of curricular development and improvement of the overall instructional program.

The trend is seemingly toward more and more state and federal programs with little emphasis on local effort. There is a need for starting a reversal of this trend because:

1. The local teachers are the factors for success or failure of the program.

2. The local groups receive curriculum materials from state and national groups, but the local directors and administrators have the difficult task of getting this material in a form that can be taught by the instructors.

3. State and federally-prepared materials are not regularly used.

4. Many times, the buildings and equipment are not used in an effective manner.

Visual aids prepared by the instructor are used more effectively than ready-made purchased units. School time should be allowed for instructors to prepare these teaching aids. The staff should be employed on a twelve-month basis to be effective.

The following statements pertain to promoting a strong, continuing student appeal and/or interest:

1. The student should be helped to realize that his learning is going to aid him in accomplishing his ambitions.

2. The student should be encouraged to feel that he can "get it."

3. The student's curiosity should be aroused.

4. The student's desire for praise and recognition for good work should be stimulated.

5. The student's fear of ridicule, punishment, or loss of self-respect should be used advantageously.

6. The teacher should capitalize on the built-in drive known as "challenge."

Effective technical programs should include the following features:

1. The inclusion of shop and laboratory experiences in the very first stages of the program.

2. The use of applied and related academic courses instead of the "canned academic courses."

3. The use of knowledgeable teachers.

4. Some knowledge and concern by the faculty for understanding the ways the present adolescent sub-culture functions.

5. The development of an active placement service.

6. The establishment of a businesslike approach in dealing with students.

7. An awareness of the fact that the general appearance of the school has some bearing on the students' pride in attending.

8. Provision of counseling services and remedial programs.

9. Assistance to student in understanding his objectives and helping him to overcome his major frustrations.

10. The acquaintance of the student with the use of the independent research and development aspect of his curriculum early in his program.

11. The use of student evaluation sheets to assist in finding weak spots in the instructional program.

In training for skilled jobs, we are trying to develop technical and manipulative skills for job-entry into a single trade. However, in technical education, we are developing technical skills for entry into any one of a cluster of related technical occupations. There are different types of technicians as listed below:

1. Low level, narrow scope.

2. High level, narrow scope.

3. Industrial technician.

4. Engineering technician.

One of the factors to be considered in curriculum development is pre-planning by job clusters of various technicians.

In developing a curriculum, both the needs of industry and our human needs must be considered.

We must get more common understanding and build some strength in technical education through future curriculum development where it can be more highly respected by industry and can achieve a permanent place in the whole educational spectrum.

Procedures for Curriculum Development

Curriculum development in an institution should include the following:

1. Set up the objectives for the institution.

2. Determine the length of each course offered in each program.

3. Allow some freedom for electives.

4. Consider the entrance requirements of the institution.

It is important to watch very closely the needs as requested or stated by defense and industry. We need to know something about the replacement and growth in industry in order to adjust our curriculum to it.

To determine the need for various programs, we can secure the aid of lay people in the area and also work with the Employment Securities Commission. The involvement of more people in the community through the layman's approach often gets valid results. Many times, companies will aid in surveys to assist the technical institution in establishing and revising its curriculum.

It is essential that we have a continuous effort to anticipate the needs of individuals. Education is never terminal--it is continuous throughout a person's entire life.

Most people in technical education believe that the majority of technicians will be in the need of some upgrading at least three to five times during their work span. Therefore, we must think about and anticipate future needs.

Creativity, imagination, and a boldness or a desire to do things a little differently are the things that are required of technical education to bring it to the point where it should be. In curriculum planning, we must consider what we can give the individual in terms of technical skills, knowledge, and an appreciation of the program that will make him more productive in the society in which he lives.

Staffing Technical Education

One of the major responsibilities of an administrator or a supervisor of a technical education program is the matter of staffing. This is one of the areas on which we need to place a great deal more emphasis.

Factors to consider in staffing a technical education program are as follows:

1. Selection of the best man available.

2. The enrollments or the anticipated enrollments in the program.

3. The necessity to select, at times, a man with several competencies.

4. Whether the technical program is a day school program or an evening adult and extension program.

5 Work experience of the personnel.

6. The type and size of area where the man will work.

7. Whether program is ECPD accredited.

8. The type of degree offered by the institution as a factor in determining the educational achievements of the instructional staff.

9. The image of the institution that is projected within the community.

Qualifications of a Technical Instructor in a Technical Education Program

High School Technical Program Instructor

1. Should preferably have an associate degree with a high school diploma a must.

2. Should be encouraged to move toward a full degree if he does not have one.

3. Should have some preparation in the field of professional education or should have it provided as inserts in the early stages of his teaching career while he is on the job.

4. Should be occupationally oriented.

5. Should be the best person with regard to education and work experience that the available dollars can attract.

6. Should be a person with the necessary work experience since it is difficult to add work experience after a person is employed.

Post-High School Instructor

1. Should probably have a baccalaureate degree or be willing to work toward it.

2. Should have the necessary productive varied work experience.

3. Should have adequate technical knowledge.

4. Should have the opportunity of obtaining additional hours in professional teacher education after employment.

5. Should be able to apply what he teaches.

6. Should be the best man that can be obtained for the available money.

Supervisors and Administrators

1. Should have a knowledge of technical education as part of the total structure of vocational education and where the program of technical education fits into the broad field of all education.

2. Should have at least a baccalaureate degree and usually some hours beyond.

3. Should have potential for growth.

4. Should train their understudies.

5. Should make effective use of the principles of human relations.

6. Should have varied work experience.

7. Should have (many people believe) at least five years of vocational teaching experience.

Responsibilities of the Supervisor or Administrator

1. Leadership responsibilities include:

   a. Encouraging innovation and creativity in others.

   b. Being an intellectual skeptic.

   c. Building confidence as a result of accomplishments among our colleagues.

   d. Recognizing the ultimate importance of dealing with co-workers as human beings.

   e. Realizing that the group process basis is probably the best way to get the job done.

f. Recognizing leadership ability in other staff members and developing it.

2. Personnel management responsibilities involve:

   a. Orienting new staff members.

   b. Planning school matters cooperatively.

   c. Utilizing outside contacts such as advisory groups.

   d. Evaluating the staff periodically.

   e. Providing opportunity for each staff member to contribute to growth of the school programs.

3. Instructional supervision responsibilities include:

   a. Visiting the classroom, laboratory, and shop.

   b. Counseling with the staff concerning professional improvement.

   c. Having a sound basis for re-assignments, promotions, and transfers.

   d. Establishing criteria for evaluating instructor performance.

4. Business management and financial responsibilities include:

   a. Having knowledge of local, state, and federal regulations.

   b. Preparing budgets.

   c. Planning new buildings and making allocations for maintenance of facilities.

   d. Accounting for expenditures.

Financing Technical Education Programs

Investment in Personnel

Most vocational educators believe that the investment in personnel is probably the most valuable investment this technical age can make. The extent to which one invests in personnel determines the dividends one receives. Industry conducts educational programs for its labor force

to improve the quality of its personnel. Technical education should also invest in its programs to improve the quality of its personnel who prepare skilled workers for industry.

Factors that Influence Budget Planning

It is most important to consider the factors that will particularly influence budget planning in establishing a technical institute. Some of these are as follows:

1. Costs vary greatly depending upon the area of the country.

2. If there is a strong union labor force in the area, prices will be higher.

3. In the engineering curriculum, about 25 percent of the total cost of the installation is allotted to equipment.

4. The technical institute that is engineering-oriented in a heavy concentration of unions uses the figure of about $5,000 per student as the base figure.

5. One of the most important considerations in selecting a site for a newly established technical institute is space for adequate parking facilities.

6. Technical education should include breadth in the field of social competency, citizenship, physical education, sports, and club activities. Space needs to be provided for these.

7. The site should be near adequate freeways and highways.

8. Sewage, power, and drainage must be considered.

9. In the long run, the site is the cheapest part of the construction.

10. For a technical institute, the annual recurring costs are in the vicinity of $700 per year per student.

11. In figuring general expense items such as telephone, chalk, postage, and others, the rule of thumb figure is $20 per student per year.

12. The publication by J. N. Morris, Planning A School Maintenance and Repair Program, issued by the American Institute for Architects, might be useful in planning a school.

It suggests to figure, on a national average basis, 16 cents per square foot per year on recurring repairs; 7 cents per square foot per year for replacements of things that burn out, wear out, and break; and 8 cents per square foot per year for improvements.

13. The number of administrators and supervisors necessary to fulfill the technical programs' objectives should be employed.

14. The general rule of thumb is that the ideal teacher to student ratio in the manipulative skills is about one to fifteen. In the general liberal cultural elements of the program, it might be thirty students per instructor; however, this may vary greatly.

15. A strong public relations program must be in operation before the school is built and the curriculum is organized.

Supervision and In-Service Teacher Education

In-service teacher education includes any activity made available to the practicing teacher that will enable him to become a better teacher.

In some programs, it is apparent that there is a need for revising existing curricula or developing new curricula for the preparation of teachers.

Some purposes served by student ratings of instructors are as follows:

1. Serve as a means of expression of student opinion affording students a feeling of participation.

2. Furnish research data on student ratings, student-faculty interaction, and on the source and nature of student opinions.

3. Furnish specific diagnostic information to the instructor about various aspects of his performance as viewed by his students.

4. Furnish a source of motivation for an instructor to want to improve or maintain good instruction.

5. Furnish data of an objective type for administrative purposes in evaluating performance of staff members.

Accreditation

At the present time, the National Council on Accreditation of Teacher Education is charged with the responsibility of accrediting institutions offering teacher training programs. One of the big difficulties in technical education is the fact that there have been no established standards that have been circulated nationally to identify the criteria to be used in accrediting programs for preparation of teachers of the various technologies.

Establishing Research and Development Needs

The need for research and development in the field of technical education is greater than in any other educational field that now exists. This is partially due to the fact that this is a relatively new facet in our total spectrum of education. It is also due to the fact that we do not have an adequate number of competently trained researchers in the field of technical education.

Manpower Studies

One of the most critical needs for collecting data today is in the area of information relating to the need for technical manpower.

It has been found that too many times the term "technician" is applied across a broad spectrum of levels of activities in a particular corporation. Care must be taken to gather information that relates to data applicable to the proper interpretation of the classification of technician.

Data from manpower studies can be tremendously important to the local administrator of a comprehensive community college or technical institute. It will enable him to structure curricula that will be in the greatest demand in the local community. However, the demands of the state and nation must also be considered.

Student Selection Studies

An important facet of technical education that needs much research is student selection. More schools need to develop specific criteria for the selection of students for technical education programs. Instruments and techniques that help in determining the probable success of applicants for post-high school technical education should be identified through research.

Teacher Preparation Studies

A great deal of work remains to be done to develop a curriculum for technical teachers. Experimental research programs are needed to investigate the kind of teacher preparation programs that are best suited to developing technical teachers.

In view of the great shortage of qualified technical teachers, new methods have to be developed to re-train persons who have received basic training in other disciplines and to prepare them to be teachers in the various technologies.

Other Research Needs

A checklist of some important research needs are listed below:

1. The impact of the change of the labor market.
2. The effect of automation on our programs.
3. The areas of new technologies.
4. The teaching methods and instructional innovations that are best suited to handle the training needs.
5. Updating our instructional staff.
6. The areas of placement and follow-up.
7. The use of advisory councils.

OTHER CENTER PUBLICATIONS

"Guidelines for State Supervisors in Office Occupations Education." 1965 Business Clinic

A Report of a National Seminar on Agriculture Education, "Program Development and Research.

"Guidance in Vocational Education." - Guidelines for Research and Practice.

"Research Planning in Business and Office Education."

"Evaluation and Program Planning in Agricultural Education."

"A Report of a National Seminar on Health Occupations Education Centers."

"A Report of a National Seminar on Cooperative Education."

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"Systems Under Development for Vocational Guidance." - A Report of a Research Exchange Conference.

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"A Survey of Vocational Education Programs for Students with Special Needs."